The Only Journal With a Paid Circulation in the Rock Products Industry

Rock Products

Entered as second-class matter, July 2, 1907, at the Chicago, Illinois, Postoffice, under the Act of March 3, 1879.

Published Every Other Saturday by

Tradepress Publishing Corporation

542 South Dearborn Street, Chicago, Illinois

MEMBER A. B. C. MEMBER A. B. P.

W. D. CALLENDER, President GEO. P. MILLER, Treasurer
N. C. ROCKWOOD, Vice-President C. O. NELSON, Secretary

NATHAN C. ROCKWOOD, Editor

H. E. HOPKINS, GEO. M. EARNSHAW, Associate Editors

CLINTON S. DARLING, Promotional Manager

C. A. BRESKIN, Advertising Manager J. K. COSTELLO, Central Rep.
E. M. GIBSON, Assistant Manager A. B. SANGER, Eastern Rep.

GEO. P. MILLER, General Manager

SUBSCRIPTION—Two dollars a year to United States and Possessions. Three dollars a year to Canada and foreign countries. Twenty-five cents for single copies.

TO SUBSCRIBERS—Date on wrappers indicates issues with which your subscription expires. In writing to have address changed, give old as well as new address.

Volume 25 December 30, 1922 Number 26

CONTENTS

A Happy New Year—and Many Thanks

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In looking back over 1922 the ROCK PRODUCTS staff—editorial, advertising, and circulation—see one outstanding feature of the year which it is fitting to mention at this New Year's time. The co-operation which has met on every hand the efforts of ROCK PRODUCTS' men and women is exceptional for its warmth and sincerity. Without such co-operation ROCK PRODUCTS' service to the industry could not have been so valuable. Information from owners and managers about plant operation and equipment has been freely given; manufacturers of machinery have taken advantage of advertising pages to tell about effective equipment; new readers have shown a real desire to profit from the pages of the magazine.

Co-operation of this nature is highly appreciated, and ROCK PRODUCTS takes this opportunity to thank all—plant operators, subscribers, and advertisers alike—for the assistance making possible a magazine which has served the industry and, we trust, has served it well.

Results of this co-operation have been apparent in each issue of the year, both in the editorial and in the advertising pages. Results are particularly evident in the pages of this Annual Review and Directory Number, which we hand to you for your assistance and for your judgment, with a most sincere wish for a happier and more prosperous New Year than you have ever before experienced.

* * *

The Beginning of Permanent Quarry Literature

WHO ever has tried to find in one volume a comprehensive treatment of quarry and crushing plant practice has met with disappointment. What literature there is of practical assistance and value to quarry owners and managers is scattered through many publications and various periodicals.

One of the aims in the coming convention of the National Crushed Stone Association was to assemble recognized experts on various phases of quarry operation and management. Another aim is to put into permanent and usable form the valuable information derived from the papers of these experts and in the subsequent discussion of the papers by quarry men.

In pursuance of these aims the editor of ROCK PRODUCTS was appointed, by vote of the executive committee of the association, chairman of the program committee of the National Crushed Stone Association—of which ROCK PRODUCTS is an associate member—and ROCK PRODUCTS was given the exclusive right to publish the entire transactions of the convention, properly compiled, edited, and indexed, thus making available to the quarry industry a comprehensive Quarry Manual.

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1 *Chabelco Pins are case-hardened to resist wear. Flat end prevents rotating in outer sidebar.*

2 *Chabelco Sidebars are made from high carbon steel and are punched and broached so as to lock both pin and bushing.*

3 *Chabelco Bushings are case-hardened and lock in sidebars to prevent turning.*

4 *Chabelco Rollers are made from special analysis open hearth steel and are accurately machined*

Why we recommend REX CHABELCO for all hard drives

Because of its records for powerful, economical service, Rex Chabelco Chain is being used increasingly in quarries, cement mills, gypsum plants and sand and gravel pits.

Rex Chabelco is especially constructed for high speed, heavy duty transmission and conveyor work. It is built entirely of steel and shows a stubborn resistance to the wear of abusive materials. Sudden impact strains have little effect upon it. ***It holds its pitch better, runs smoother and lasts much longer than ordinary chain can.***

You will save money by putting Rex Chabelco on all your hard, punishing drives. If your machinery is not now so equipped, insist on Rex Chabelco for your next replacement. Its uncommon durability makes it the cheapest chain you can buy.

CHAIN BELT COMPANY, MILWAUKEE

Branch Offices and Representatives in Principal Cities in the United States and Abroad

REX CHAIN

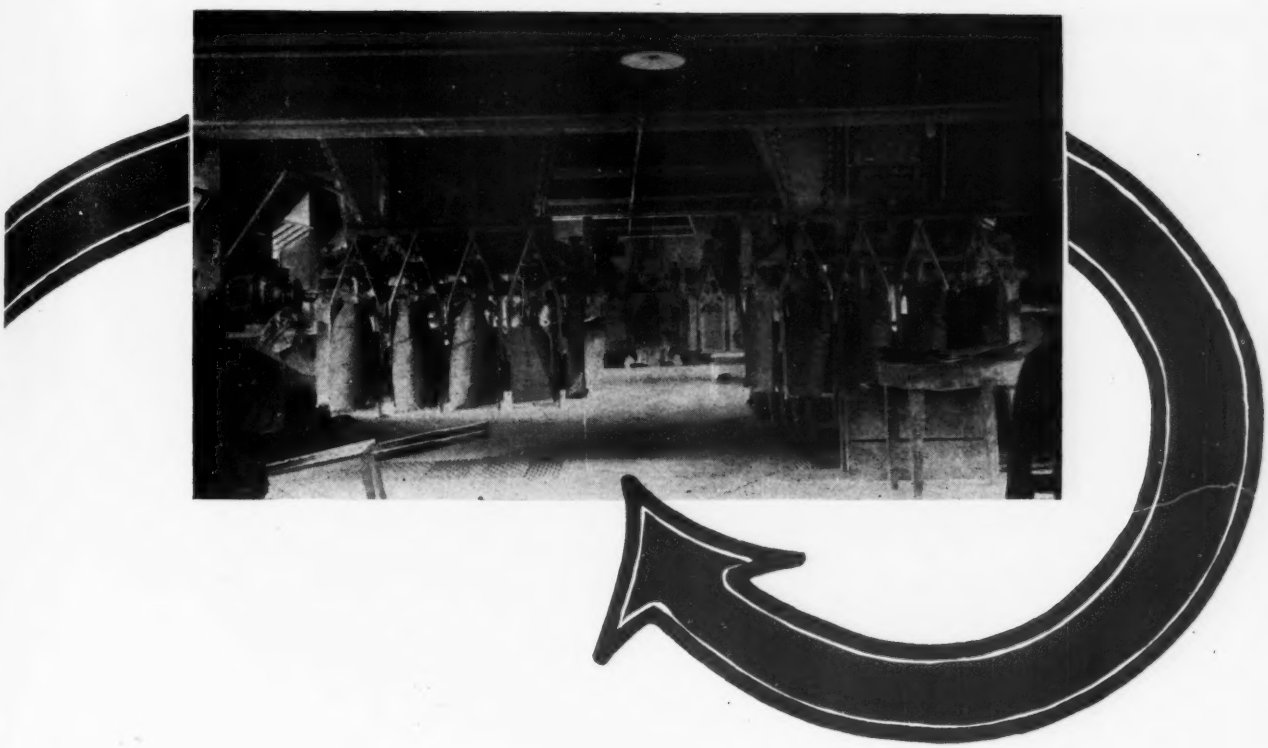
Rex Sprockets, Rex Conveyors, Rex Concrete Mixers and Pavers, Rex Traveling Water Screens

Every steady producer of lime or any other product that requires bagging in such a way that the contents will be intact when the destination is reached will profit by learning of the unusual economies possible by using the Bates System.

Throughout this great United States, and in many foreign countries Bates Valve Bag and Sackers have demonstrated their unusual value—have demonstrated the fact that it is the most efficient and economical system of packing loose materials.

The trouble-free performance and the quick clearance that makes this wonderful self-sealing, bag-filling system so valuable, enables

BATES



your plant to increase production with the positive assurance that it will take care of the material as fast as you can produce it.

There never was a time when the reputation for producing a sound product meant so much as now. Men are weighing as never before, the value of every dollar against what that dollar will buy.

The Valve Bag Company of America is a good company, an institution built up on the intent to serve producers of non-metallic minerals with a machine that will make new records in bagging, and last a long time with less trouble and less expense.

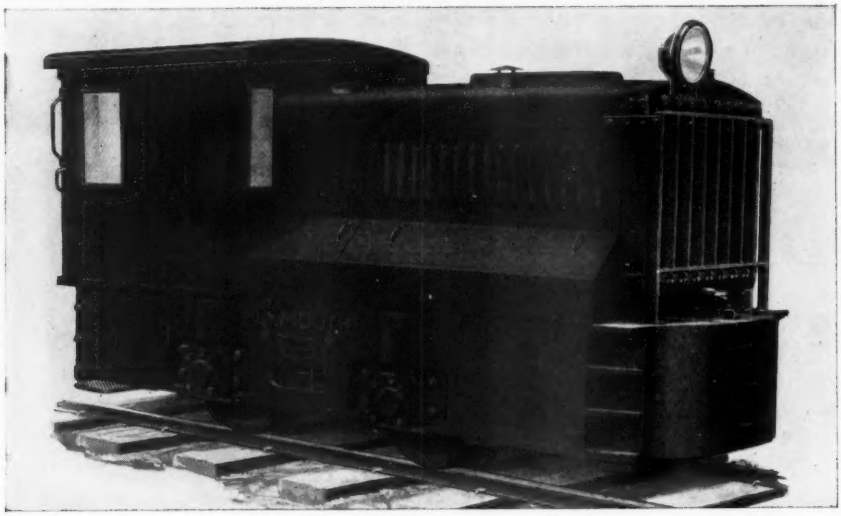
Better learn about the Bates System

THE VALVE BAG COMPANY OF AMERICA

TOLEDO, OHIO

Branch Plant: Windsor, Ont., and Oakmont, Pa.

VALVE BAG *and* SACKERS



Announcing the Plymouth

No part of an Industrial Locomotive is of more vital importance than its Transmission. No matter how good or powerful the Engine or Power Plant all power must be transmitted through the Transmission. It can be either the strongest or weakest link.

When we designed the 7 ton, 4 speed, Plymouth Gear Drive Locomotive we gave the Transmission our first consideration. We have spent **years** in the study and experiment of transmissions. Not until after long, hard and grueling tests in actual road work—tests that showed this Locomotive would develop and maintain a drawbar pull of 5250 lbs. on sanded rail—were we satisfied with this transmission.

There must be reasons for this remarkable performance. There are.

1. **Transmission has exclusive feature of a final driving gear and shaft housed in the gear case compounding the ratio of the other gears.**
2. **All Gears unusually large and massive, final driving gear being 14½" diameter by 4" face. Other gears 2" and 2¼" face of large diameter.**
3. **All Gears made of alloy hardened steel, mounted on extra heavy shafting and ball bearings.**

PLYM
Gasoline

4 Speed Gear Drive Locomotive

4. **Gears that are driving are the only ones in mesh.**
5. **No Jack Shaft required.**
6. **No Jaw Clutches.**
7. **Driving Sprockets on same horizontal plane with axles.**
8. **Only two short Drive Chains—both extra heavy.**
9. **All Ball Bearings inside of Gear Case, from which they are lubricated.**
10. **Clutch has nine driving discs faced on each side with non-burnable facings. Very smooth in action.**

Plymouth Gear Drive Locomotives are not an experiment. They have been tried, tested and proved. They are at work in road construction, quarries, sand and gravel pits and industrial plants—and the numerous repeat orders attest the exceptional service.

See the Plymouth Gear Drive at the Good Roads Show, Chicago — or write for literature.

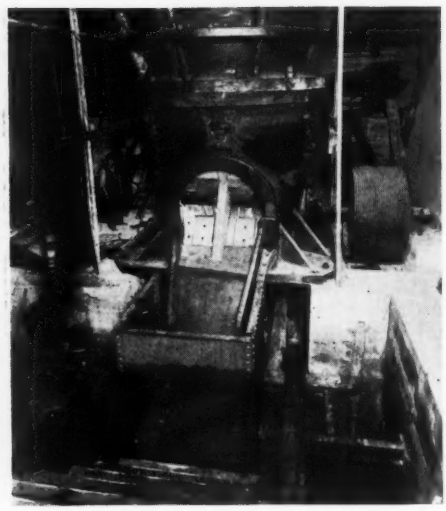
THE FATE-ROOT-HEATH CO., Plymouth, Ohio

OUTH
Locomotives

Four 60" Revolving Screens

General View Plant

ALLIS-CHALMERS



No. 24 Gates Crusher

KELLEY ISLAND LIME AND T

The Kelley Island Lime and Transport Company is the largest producer of fluxing and commercial crushed stone in the world. When the great improvement and extension of their Marblehead plant was considered, it was but natural for them to call on the largest producers of crushed stone equipment, not only for the necessary machinery, but for engineering assistance.

The Marblehead plant is unquestionably the world's greatest achievement in the design and construction of a crushed stone plant.

Economy and efficiency in quantity production has been mastered by the co-operation of Kelley Island officials and the Allis-Chalmers Engineering Department.

Allis-Chalmers Equipment at this plant includes Crushers, Pan Conveyors, Screens, Elevators, Belt Conveyors, Quadrant Bin Gates, Transmission and all Electrical Equipment.

The primary crushing plant is unusual in that it is composed of two No. 24 Allis-Chalmers gyratory crushers each having two 48-inch openings which are located side by side to permit unit operation of the plant.

The Pan Conveyors that carry the material from the primary crushers to the screening house are the largest in the world. There are two of these conveyors with 72-inch pans and 176 feet

ALLIS-CHALMERS

MILWAUKEE,

Trainload Crusher Parts

EQUIPMENT

TRANSPORT COMPANY

Crusher Hopper—Two No. 24 Gates Crushers

long between centers, carrying material up a 45-degree incline. Due to their unusual length, these conveyors are provided with an equalizing device.

Two No. 8 "K" Gates Gyrating Crushers reduce the oversize discharge from screens.

The screen house equipment consists of four 60x24 and four 48x20 steel frame closed end gates revolving screens, also four 5x10 double-deck shaking screens.

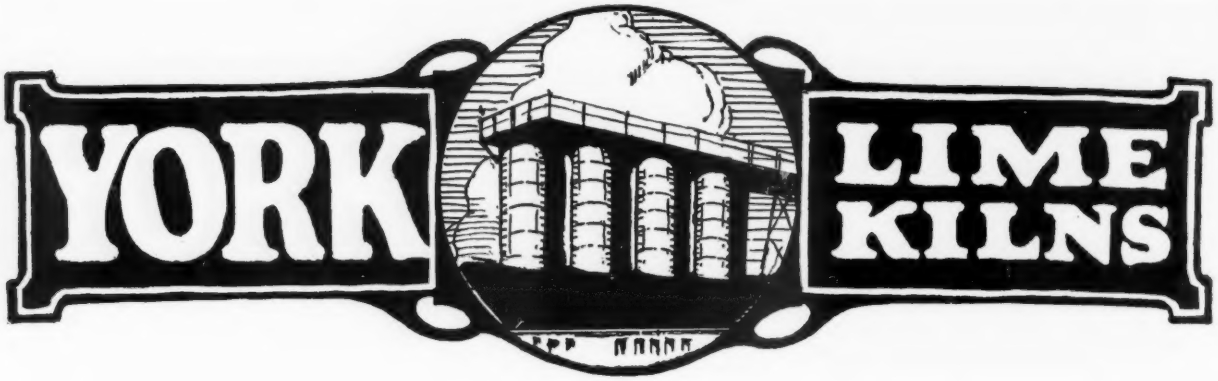
The electric power arriving at 23,000 volts, 3 phase, 25 cycle, is stepped down to 460 volts through three Allis-Chalmers 500 K. V. A. single phase insulated self cooling transformers.

Electric motor equipment is of the slip ring type and includes two 200-horsepower for Primary Crushers, two 200-horsepower for Pan Conveyors, four 25-horsepower, four 20-horsepower and four 10-horsepower for Screens, two 75-horsepower for Secondary Crushers, two 20-horsepower for Bucket Elevators and smaller motors throughout the plant for Belt Conveyors, Cranes and other uses.

The plant was designed, and all principal machinery furnished by Allis-Chalmers Mfg. Co. under the Allis-Chalmers plan of undivided responsibility.

MANUFACTURING CO.

WIS. U. S. A.



A Kiln for Each Operation

—*Rotary or Shaft*—

The York Kiln is a development in design and construction along the lines of sound and proven engineering principles.

This development makes positive a high thermal efficiency with a low fuel consumption, cutting the "per ton" cost of calcination to the minimum.

Each limestone deposit requires special investigation and treatment in order to secure proper results. We aim to co-operate with producers along these lines, and while we build kilns of our own design, we always incorporate the experience and plans of operators into the design of the kiln wanted.

We have a working arrangement with the foremost lime and hydrating engineer in the country. This plus our wide practical experience, skill and technical qualifications, enables us to render an unusual service to lime producers.

We also manufacture:

Dryers
Hydrators
Gas Producers
Rotary Screens
Tanks
Grey Iron Castings
Special Machinery from Engineers' Designs

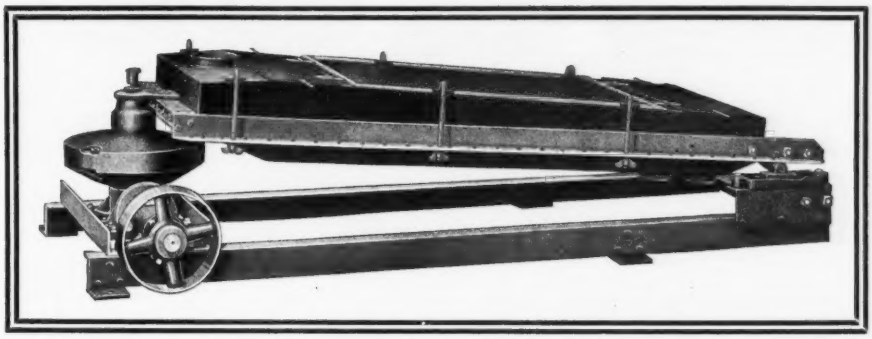
McGANN MANUFACTURING COMPANY, Inc.

Works: York, Pa.

332 South Michigan Avenue
Chicago

50 Church Street
New York

ROTEX
COMPACT SIFTERS



No matter how difficult your sifting problem may be, the Rotex will solve it for you.

No matter what the material is, whether it is bone-dry, damp or semi-liquid, the Rotex will sift it.

The basic feature which has contributed the most to the success of the Rotex is the sieve cloth cleaning system, on which we hold the patent issued in May, 1918, and which is employed in no other system.

This device, which is illustrated by diagram below, consists of suitably arranged inclined surfaces for causing many small balls to be thrown sharply upward against the under side of the nearly level gyrating sieve cloth.

The Rotex screen cleaning system prevents the gradual closing of Rotex sieves and insures continuously uniform separation. The action of the rubber ball and bevel strip cleaners is such that the rubber balls tap the under side of the sieve cloth or screen at the rate of 300 or more taps per minute on every square foot of cloth.

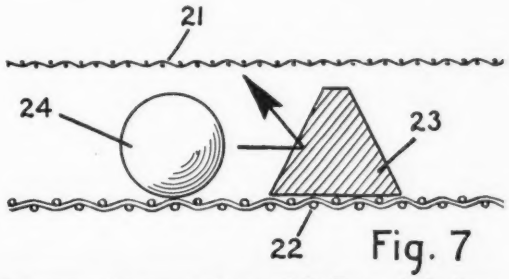


Fig. 7

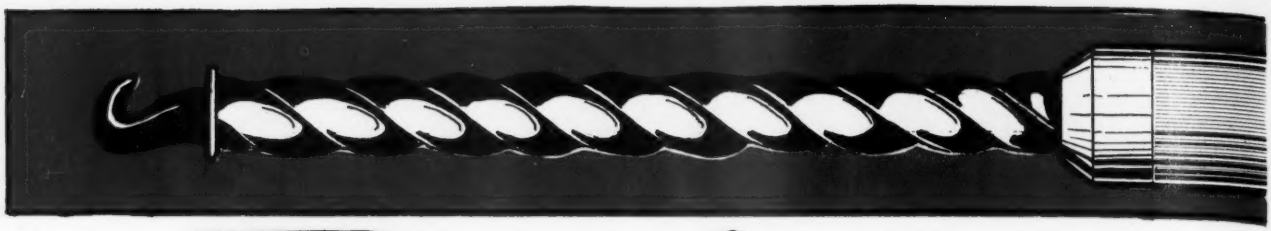
Diagrammatic representation of the Rotex cloth cleaning system, substantially as shown in the patent office drawing.

21—The sifting cloth.
22—The coarser ball support screen.
23—The inclined surface for deflecting the ball upward.
24—The ball, usually of rubber.

The Rotex will positively sift more per unit of sieve area than any other type of sifter, and we will gladly try this out with other makes to prove our assertion.

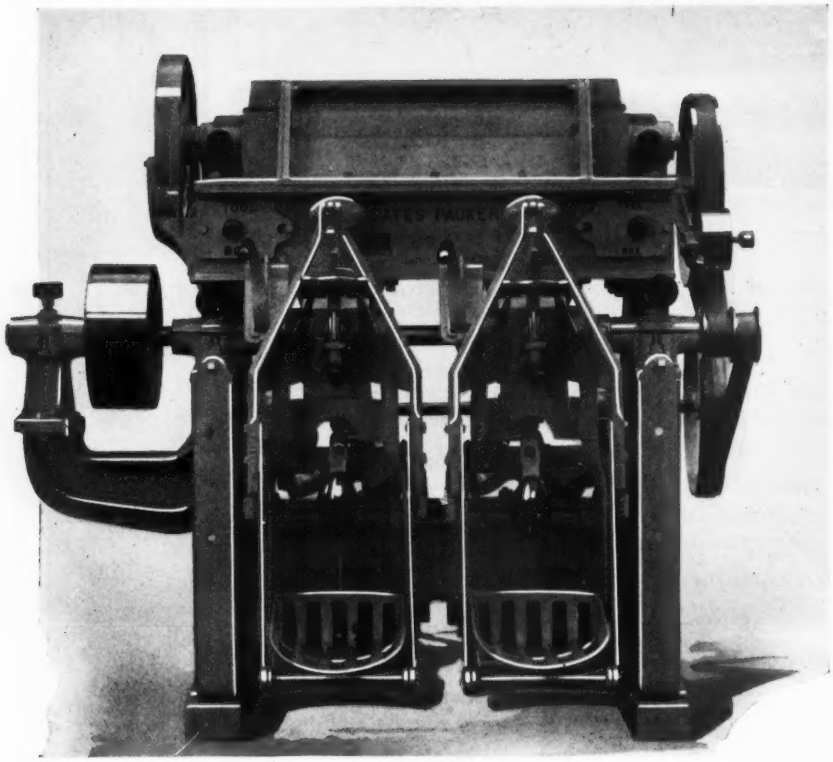
We have a 30-day trial offer which is of interest to all producers of rock products in meshes between 2 and 300 per lineal inch.

THE ORVILLE SIMPSON COMPANY
1256 Knowlton St. Cincinnati, Ohio



Bates

for Filling a



TWO TUBE TYPE
Capacity 25 tons or 500 bags of 100 lbs. per hour.
Requires 10 horsepower

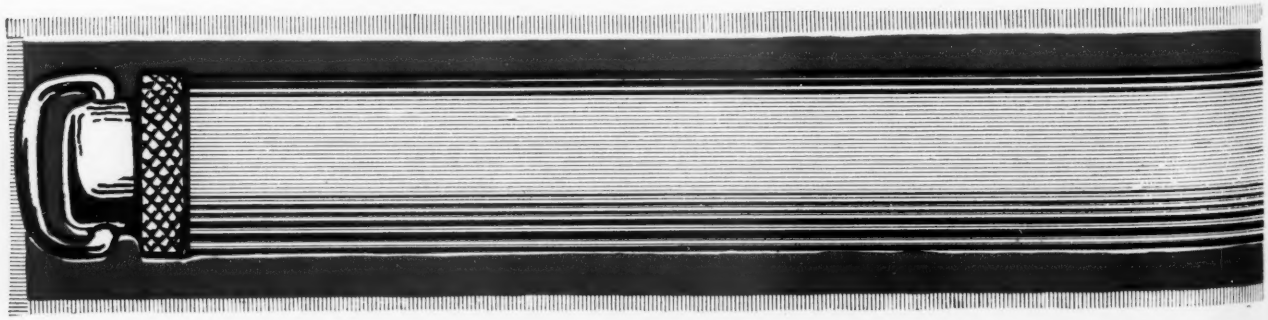
Bates Packers

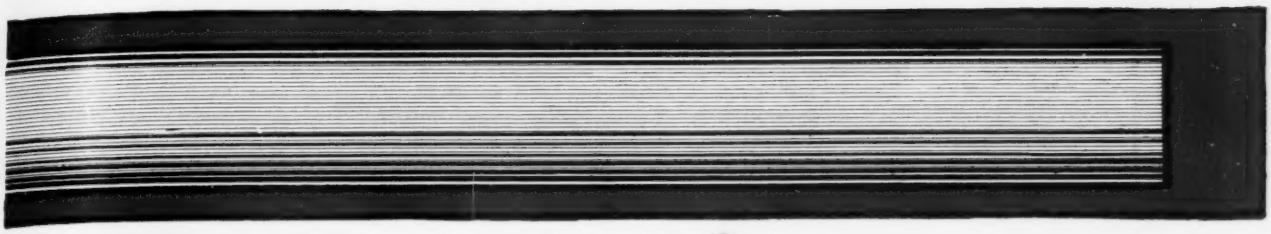
Standard in every country for packing cement, gypsum, limestone products, fertilizer, talc and all other non-metallic minerals.

We build a type and style adapted to each product and for valve or open-mouth bags.

Our Engineers will solve your sacking problem for you on request.

BATES VALVE BAG COMPA





System

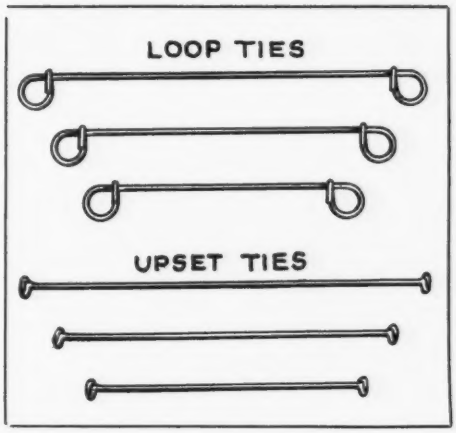
nd Closing Bags

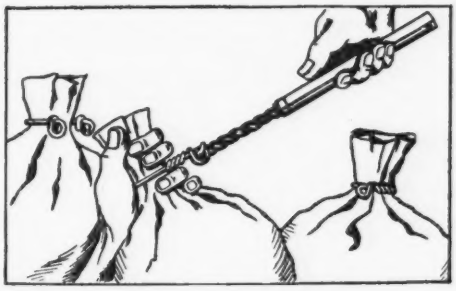
Bates Bag Ties

Made in various lengths with loop or upset ends.

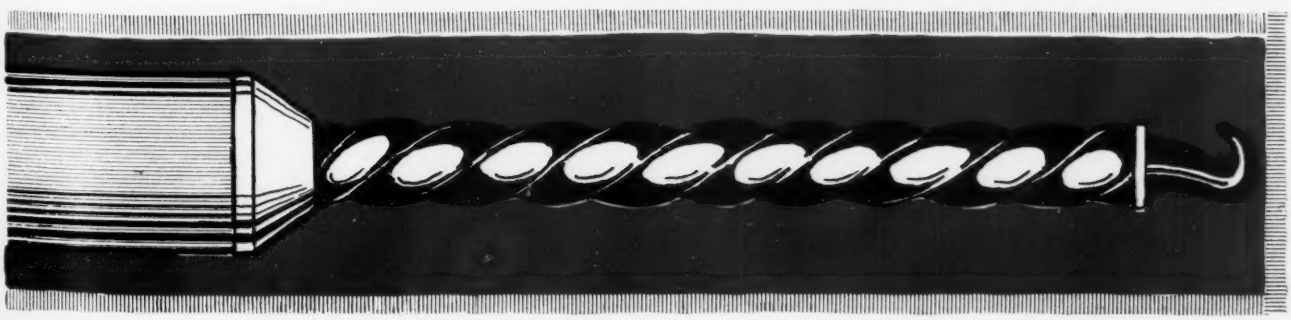
Bates bag tie spring return tools for applying ties are illustrated actual size at the top and bottom of these pages.

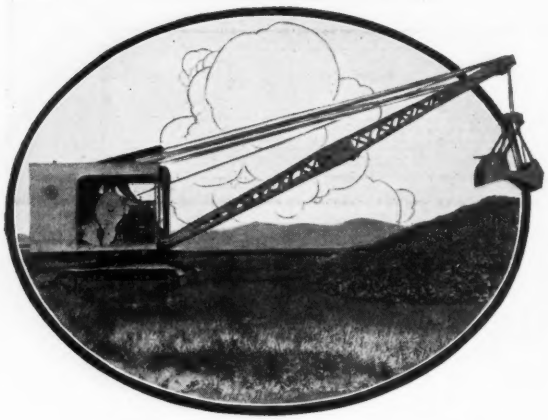
No matter what you sack or the size sack used, same can be tied more economically and efficiently with Bates Ties.





NY — Chicago, Illinois, U. S. A.





Five Features

1 Boom the loaded clamshell bucket in and out with each successive load. No harm with the Koehring. It is built for it—and it saves the wear, fuel and time of traveling the crane between every bucket load, or, where traveling is restricted it increases the range of usefulness and the amount of output.

2 No sets of interlocking gears or clutches with dual uses—which means mechanical simplicity, simplicity of operation and quick interchangeability for different kinds of work.

3 **All Functions are independent of other functions.** Hoisting, peaking, sluing or rotating, propelling—each can be operated separately or in any combination.

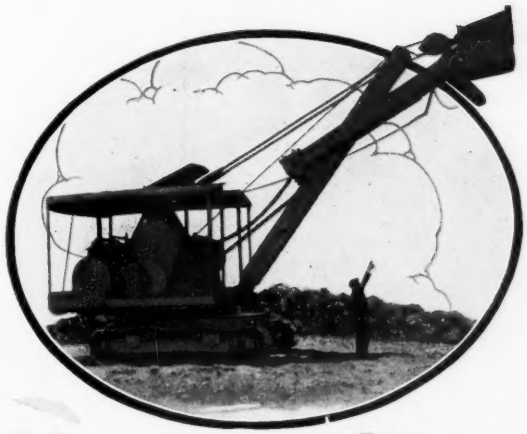
4 **Two line speeds.** To change from dragline work to grab bucket, merely change buckets and shift a clutch. No gearing or drums to be changed.

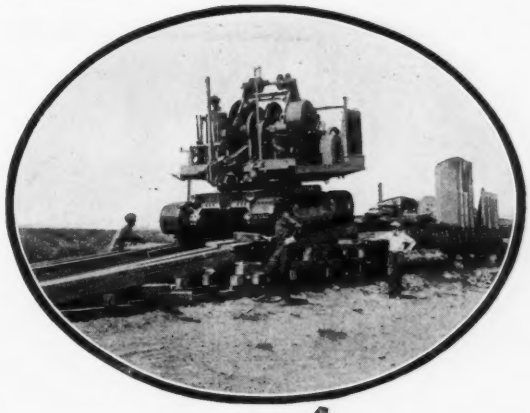
5 To change to power shovel—just change booms, add dipper handle and shovel with cable and drive parts.

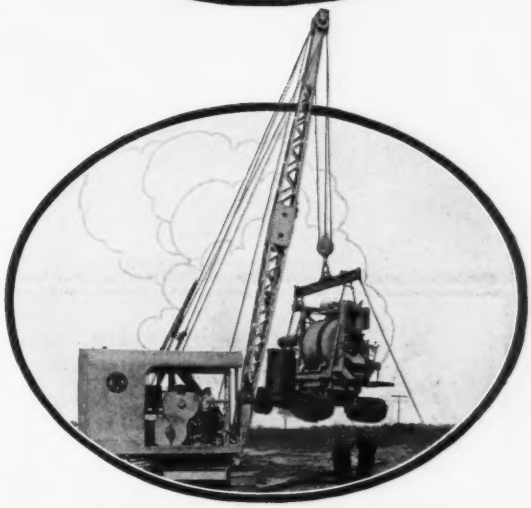
KOEHRING COMPANY

Manufacturers of Concrete Mixers and Crane Excavators

Milwaukee, Wis.







LIFTING CAPACITIES

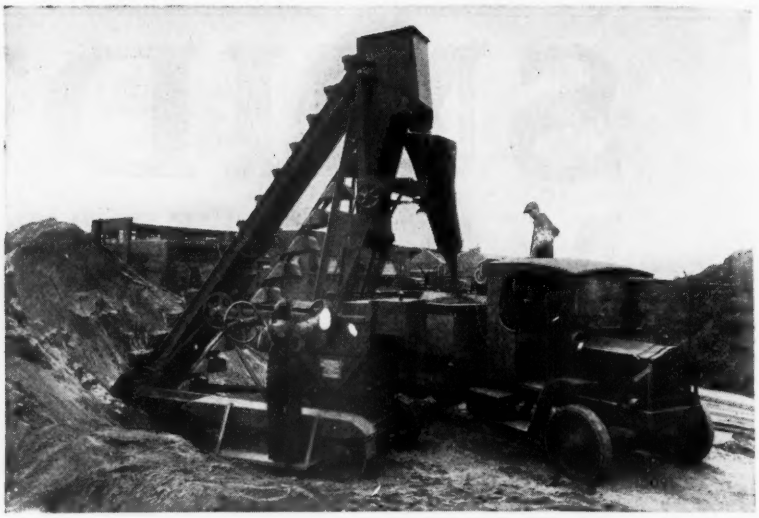
No. 1 CAPACITY: No. 1 is a smaller size, ideal for stock piling. Capacities: ¾-yard bucket at 25′ radius. 7 tons at 12′ radius. Gasoline engine, full length multiplanes.

No. 2 CAPACITY: 12 tons at 12′ radius. ½-yard clamshell bucket loaded with sand or gravel at 45′ radius. ¾-yard clamshell bucket loaded with sand or gravel at 40′ radius. 1 yard clamshell bucket loaded with sand or gravel at 33′ radius. 1¼ yard clamshell bucket loaded with sand or gravel at 24′ radius. 1 yard Page drag bucket on a 40′ boom.

No. 3 CAPACITY: 20 tons at 12′ radius. 1 yard clamshell bucket loaded with sand or gravel at 50′ radius. 1½ yard clamshell bucket loaded with sand or gravel at 40′ radius. 2 yard clamshell bucket loaded with sand or gravel at 33′ radius. 1½ yard Page drag bucket at 40′ radius.

Send for Crane Bulletins

Scraper or Clean-up Device enables the Jeffrey Tanktred Loader to readily pick up small scattered piles or windrows of Crushed Stone.



The Tanktred Loader is especially adapted for service where the ground is soft or uneven

Let These Mechanical Handlers Earn Profits for You in 1923

In the Construction of Roads and Streets

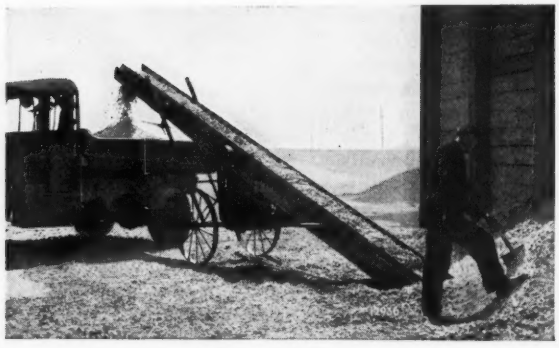
In the production of Crushed Stone, Sand, Gravel, etc., the factor of quick and low-cost handling or materials warrants your careful consideration, doesn't it?

All indications point to a continued unskilled labor shortage. You can overcome this handicap, however, and at the same time do the work in less time and at less cost through the medium of the right kind of material handling machinery.

The value of any equipment used in the hard service of handling materials in the Road Building field, in the Quarry, Sand or Gravel Plants is found in its strength and wearing qualities.

The Jeffrey reputation for quality products means too much to overlook any factor which will to any degree lower Jeffrey standards.

Ask Jeffrey engineers to help you in your plans to make 1923 the most profitable in your history. Over 40 years of Jeffrey experience is at your command.



The Jeffrey Portable Belt Conveyor meets the demand for a light, inexpensive equipment

A typical road contractor's plant showing **Jeffrey Type "A" Swing Hammer Pulverizer**

Type "G" Radial Loader. Will turn a complete circle with either drive wheel as a center

Note the small space required for the Type "G" Radial Loader to turn in

Jeffrey Material Handling Equipment Includes a Complete Line of

Portable Bucket Loaders—TANKTRED and RADIAL Types—capacities 1½ to 2 cubic yards per minute.

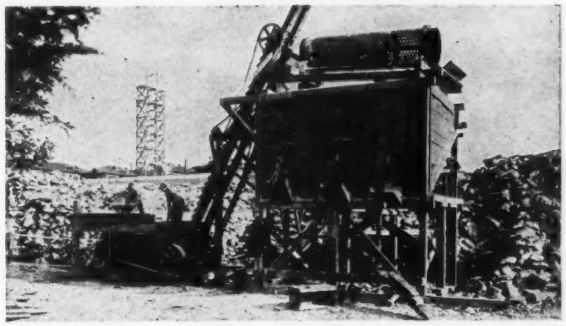
Portable Belt Conveyors—in various lengths and adapted to various heights.

Bucket Elevators—56 standard sizes—ranging in capacity from 6½ to 80 tons per hour.

Conveyors of the Belt, Buckets, Pan, Apron, Spiral, Chain Scraper, and other types.

Swing Hammer Pulverizers—for reducing Limestone, Gypsum, Marl and other friable materials.

Industrial Locomotives—Storage Battery and Trolley Types.



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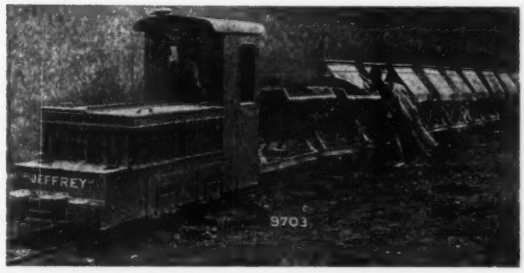

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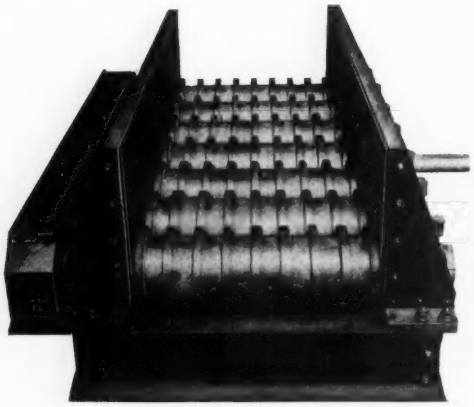

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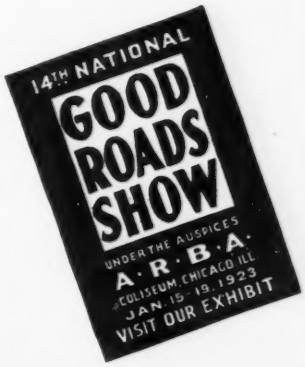

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A Margin of Results Over Expectations

DURING the past year, a quarry was opened on a bald knob of granite in the mountains of North Carolina, near the village of Hiddenite. It was a formidable looking layout from a drilling standpoint, and like most granite propositions, the success of the operation hinged on economical drilling of the rock.

A Cyclone No. 14 Blast Hole Drill was purchased on a basis of guaranteed results—namely, that the drill could be used successfully for opening the quarry face, that it would drill 15 feet per ten hour day in the hard and abrasive rock, and that it would operate at lower cost and upkeep than any other drilling equipment of any type or make.

You will admit that this guarantee took in a lot of territory, but for twelve years Cyclone installations have been made on a similar basis. It shows the manufacturer's absolute confidence in his equipment, a thorough knowledge of drilling various rock formations and willingness to back up his convictions by handling the engineering of the installation of his product.

This installation at Hiddenite required the investigation of the quarry site by a Cyclone engineer who was a practical driller and explosive man, a careful balancing of the drilling machine and drilling tool equipment for this unusually difficult drilling proposition and the furnishing of an expert drill man to execute the conditions of the guarantee.

The manager of the quarry wrote us a few weeks ago —"We are getting an average of 22 feet per day and, of course, are very much pleased; it is costing us about 53 cents per foot." A photograph taken after the first blast is shown above.

Installations equally as interesting as the Hiddenite will be found in our 100 page catalog, "Big Blast Hole Drills." This book also contains information and data on quarry drilling and blasting never before placed in print and tells why the builders of Cyclone Drills are able to cover their equipment with such an iron clad guarantee as described herein.

THE SANDERSON-CYCLONE DRILL CO.

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Rock Products

Volume XXV | Chicago, December 30, 1922 | Number 26

World's Largest Combination Flux and Commercial Crushing Plant

Double unit plant of the Kelley Island Lime and Transport Co. to have capacity of 10,000 tons in eight hours

THOROUGHLY in keeping with its position as a leading producer of rock products* is the latest development of the Kelley Island Lime and Transport Co. at Marblehead, Ohio. This new crushing plant, both in size and in excellence of arrangement and construction, marks a notable achievement in the rock products industry.

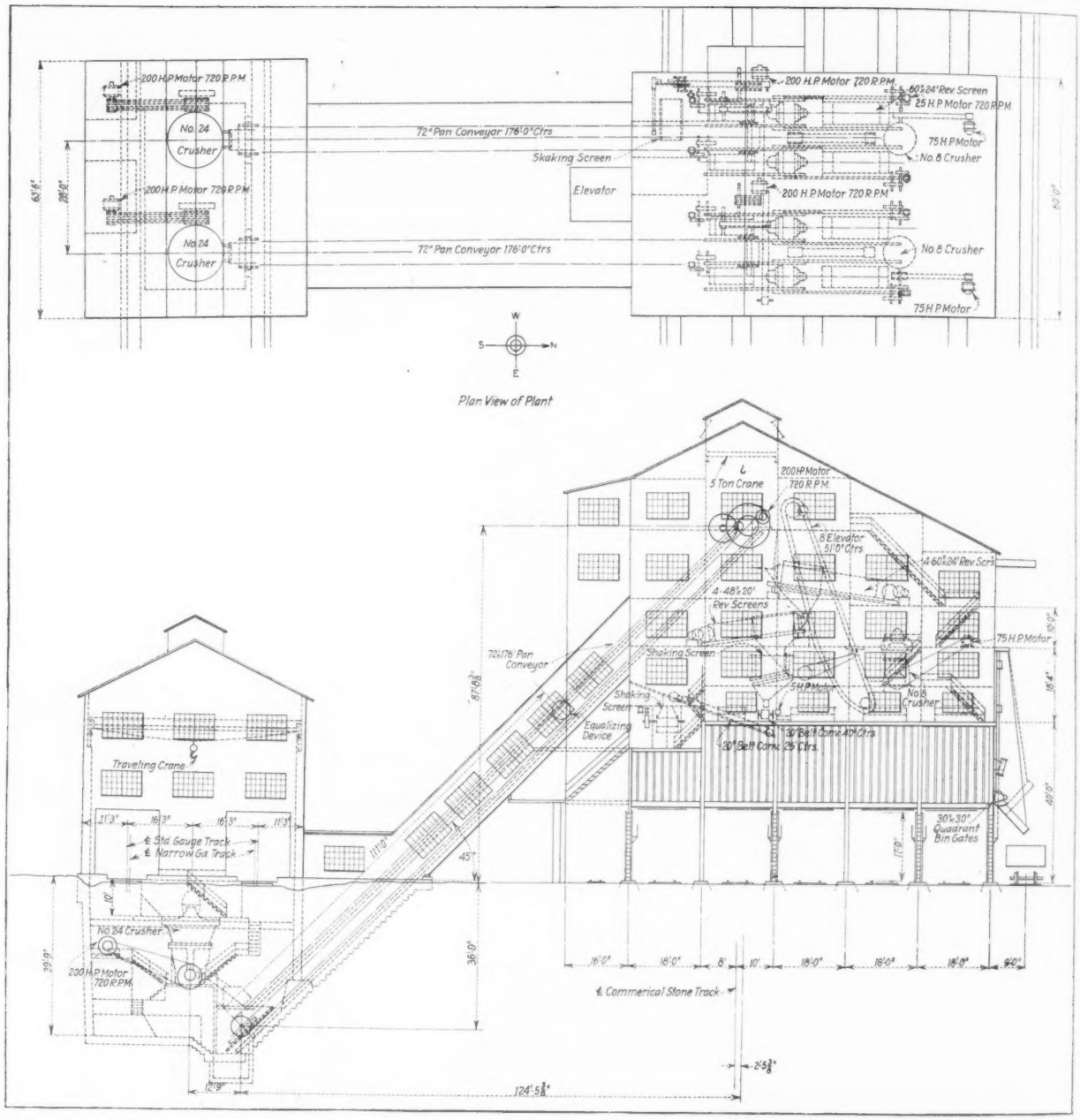
The Kelley Island Lime and Transport Co. has operated the Marblehead quarry for a number of years, the principal output being flux stone and kiln stone for lime manufacture. In addition to these main products it is also producing agricultural limestone and commercial grades of crushed stone.

The high quality of the rock and the very favorable position of the deposit, located as it is adjacent to the leading steel-making and industrial center of Ohio, and possessing facilities for both rail and water shipment, have been important factors in the building up of a huge volume of business, a volume which has outstripped the original facilities for production and rendered it imperative that the capacity and all-around efficiency of the operation be raised to the highest standard.

Quarry operators and engineers who are familiar with the multiplicity of questions that arise in connection with even the simplest quarry and crushing-plant development will appreciate the magnitude of the problem that faced the officials of the Kelley

Ten thousand tons in an eight-hour day is the capacity of this neat, compact crushed-stone plant, recently completed at Marblehead, Ohio

*The Kelley Island Lime and Transport Co. is the largest producer of crushed stone in the world. —*Editor.*



The upper portion—the plan view—shows the general layoutof the machinery. The lower portion shows the elevation and design of the building and also the loading facilities

Island company and the engineers who cooperated with them in the designing of a combination flux and commercial crushing plant of 1250 tons hourly capacity.

The description which follows of the new plant is *prima facie* evidence that the problem was solved in a most impressive and, withal, a remarkably simple fashion. Problems incident to the selection and arrangement of the plant equipment, building construction, plant location, etc., were approached in a thoroughly painstaking manner and the company officials spent considerable time in visiting several large quarry operations in different sections of the country for the purpose of inspecting the various types of equipment in service at these quarries, and arriving at a fair and unprejudiced decision as to the best machines for their own requirements.

Among the objects to be accomplished were the following, which have never been sacrificed since the first plans were discussed:

1. Safety of workmen employed.
2. Production of stone in large tonnage of merchantable products meeting the most exacting requirements of the consumer.
3. Continuity of operation to insure the trade against interruptions in the steady flow of material to points of consumption.
4. To minimize plant interruption, and to make possible major and minor repairs with the minimum sacrifice of production.
5. To provide facilities permitting utilization of full carrying capacity of railroad freight cars.
6. A compact plant, meeting local conditions, and permitting closer supervision.

Quarry and Quarry Operation

The Marblehead quarry of the Kelley Island Lime and Transport Co. has for years

been known as one of the largest in the country. Before crushing machinery and steam shovels came into use for stone-quarry operation, there were over 1000 men employed in this quarry breaking and loading stone. The company early resorted to labor-saving machinery and first installed a No. 6 gyratory stone breaker, having a capacity of from 300 to 400 tons per day. This crusher, as well as others, was soon outgrown as is indicated by successive installations of a No. 7½, 8 and 9 gyratory breaker, three of the latter being in service at one time. Later a 6x7-ft. Edison roll crusher was installed and this machine carried the burden of the production required during the recent war.

Obviously, such fast growth of the business resulted in the rebuilding of plants several times and in ways that would least interfere with continuous production of increasing tonnage, and the old frame structures, originally designed for low-tonnage machinery, began to show the strain of the vibration and racking of the heavier machinery which was later installed. At the end of the war it seemed only wisdom to provide a new plant built substantially and so designed and arranged to meet the future productive requirements.

The quarry is opened up over large areas giving a working ledge 3½ miles long. The top or first ledge is worked from 22 to 25 ft. deep of very uniform analysis and thinly stratified natural fluxing stone.

The total quarry land consists of 3000 acres, of which 400 acres have been quarried, leaving 2600 for future operation. The overburden is light, usually not over 1 ft. deep and consists of a light loam, this being removed by three Thew traction stripping shovels. In an operation of this size the disposition of stripping and byproducts from the crusher becomes a serious problem, both as to location of property on which to dump the material, and the expense of handling it. At Marblehead, land which has been quarried out is being filled with the byproducts and covered with the stripping, thus reclaiming the land and making it into excellent farm property.

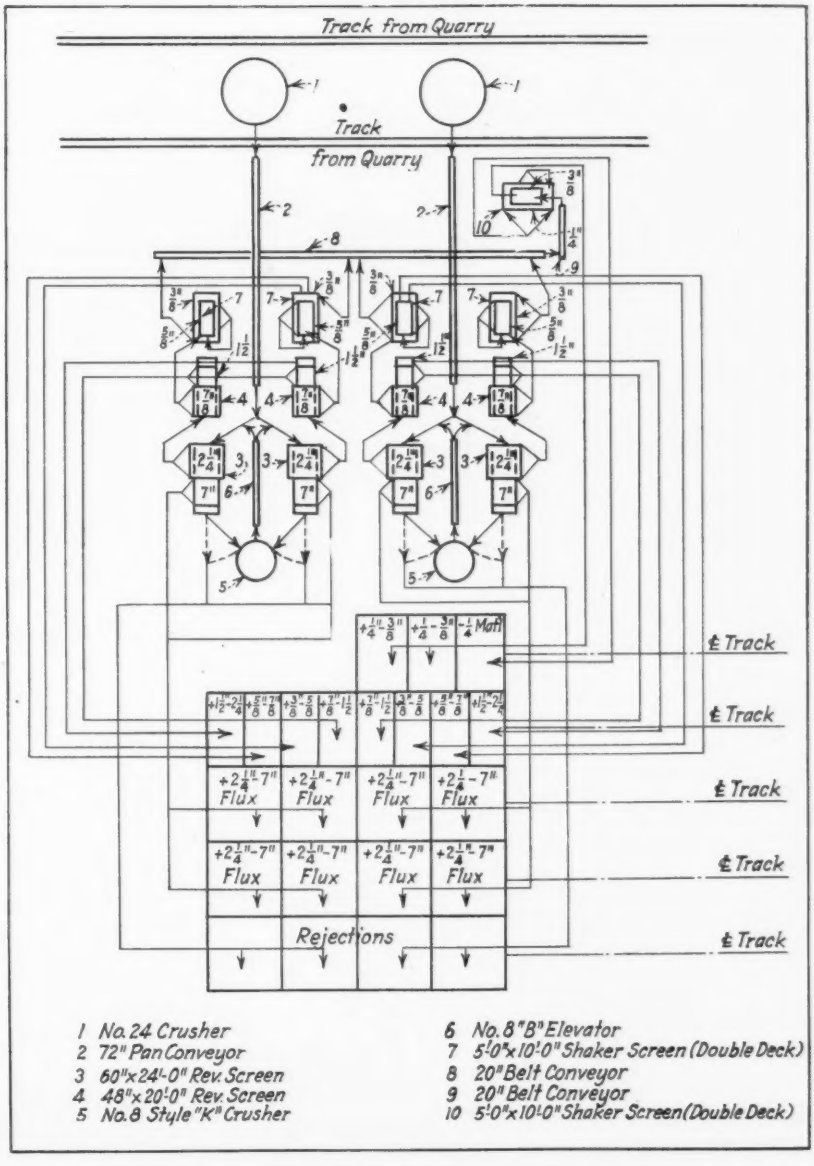
Drilling of the stone is done with eight well drills. After shooting, the quarry face is worked with 10 heavy-type railroad steam shovels and one 100-ton shovel mounted on caterpillar trucks, the latter being a very recent installation, accomplished by placing the caterpillar trucks under a shovel which formerly was mounted on railroad trucks. It is believed that this is the first attempt to use the caterpillar trucks for moving heavy-duty steam shovels in quarry operations and the results are being watched carefully by officials of the company and by many others who are interested in progressiveness in stone quarries. The shovels and crusher are now served by 21 miles of 36-in gage railroad, on which 31 geared locomotives with 360 two-way side dump cars are worked. The new plant is equipped for both standard and 36-in. gage tracks, requiring several miles of new tracks and additional railroad equipment, although by having all quarry tracks from the shovels to the main crusher built practically without grades, it will permit of increasing the number of cars per train over the number formerly hauled.

Primary Breakers

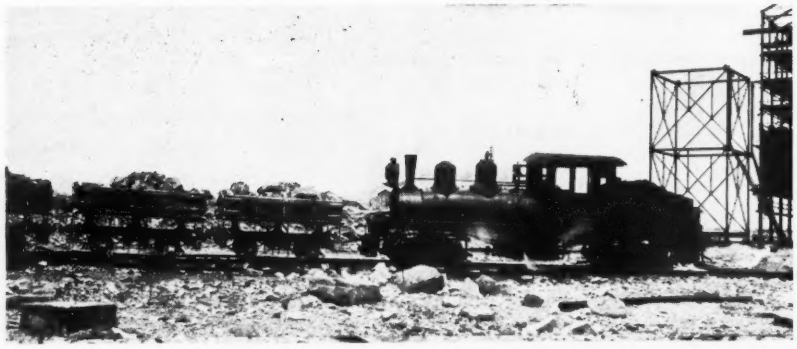
In the selection of the proper type of initial breaker for the new crusher plant all of the types in use at the present day were considered, but the problem quickly narrowed itself down to a consideration of the respective merits of the gyratory and the Edison rolls. The Kelley Island company is thoroughly familiar with both of these types from first-hand operating knowledge. The primary crusher in the old Marblehead plant was a set of 6x7-ft. Edison rolls whose operation from a mechanical standpoint was entirely satisfactory over a period of some years. It has now been replaced by gyratory crushers.

Two No. 24 Gyratory Crushers

A decision corollary to the type selection and one which will be equally interesting to the student of crushing-plant design was that of installing two primary breakers instead of one. Realizing the wisdom of the homely proverb, anent "putting all of one's eggs in a single basket," the company concluded that the two-unit installation would be a very effective measure in reducing the loss of time and production resulting from breakdowns, while at the same time the high capacity required warranted them in put-



Flow sheet of the crushing and screening plant



One of the 31 geared locomotives which, with 360 side-dump cars, transport stone to the crushers

ting in units large enough to handle shovel-loaded rock without excessive bridging and blocking in the receiving openings.

The No. 24 Allis-Chalmers gyratory breaker, having receiving openings 48x125 in. in size and capable of exceeding the required average capacity by an amount which will easily compensate for irregularities in train service, was selected as the best size for the purpose.

Initial Crusher House

The two No. 24 crushers are side by side in a large concrete-lined pit, with their tops 10 ft. below the feed tracks which run through the crusher house at grade. There are two of these feed tracks, one on either side of the crushers, and the crushers are spaced so as to permit the simultaneous dumping of six 10-yd. side-dump quarry cars three on each side. This arrangement, while it necessitated a large expenditure for excavation and foundation construction, was decided upon as being the only practicable arrangement to handle the tonnage desired. It will permit the continuous passage of trains through the crusher house on both sides of the big crushers, each and every train being intact at all times, with none of the time loss and dead equipment loss which attend the operation of the older type of incline-fed plant.

It is obvious that the operating economics effected by the "subterranean" installation will quickly repay the additional initial investment in a plant having the capacity that this plant has.

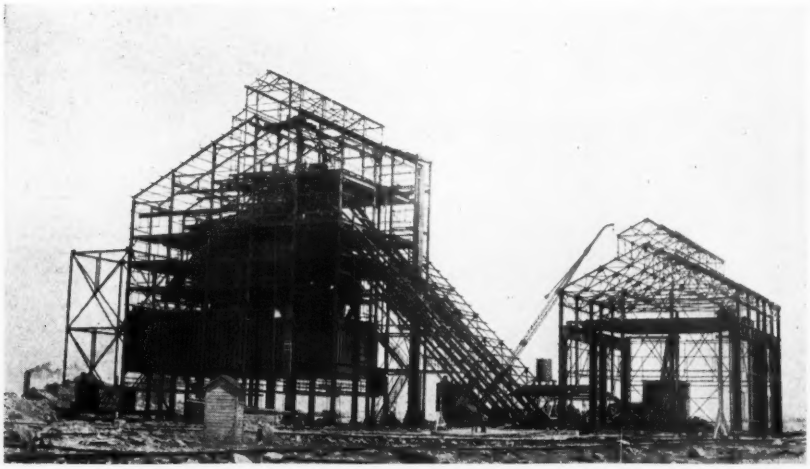
The receiving hopper above the crushers is a big steel box, the stone being permitted to form its own hopper lining. The upper edges of the hopper on the sides adjacent to the feed tracks are chamfered back to the rail to prevent the piling up of such fine material as may drop from the cars close to the rail when the load is dumped.

Dumping of those cars which do not balance toward the receiving hopper will be accomplished by air cylinders so arranged that their pistons will rise against the car body from beneath when the air is applied.

Each No. 24 crusher is driven from a 200-hp., 720-r.p.m. slip-ring motor through an English system rope drive, comprised of 26 turns of ¾-in. rope. A description of the control of these motors, as well as the other motors throughout the plant, will be found under the heading "Power."

The crusher pit, which extends 39 ft. 9 in. below ground level, is heavily lined on its four sides and bottom with water-proofed concrete and is provided with an ample sump for catching any seepage which might occur. This sump is fitted with two vertical shaft motor-driven centrifugal sump pumps equipped with automatic float switches. Either of these pumps is of sufficient capacity to easily take care of the anticipated seepage, the duplicate installation being merely a safeguard against the possible breakdown of one unit.

Part of the quarry, 400 acres of which have been opened up to give 3½ miles of working ledge. For future operation 2600 acres of quarry land remain



How the steel framework appeared during construction

An electrical bridge type traveling crane, with a lifting capacity of 50 tons, spans the crusher house about 43 ft. above the top of the crushers. This crane will handle the heavy crusher parts when making repairs or replacements and will also be used for breaking bridges and blockades in the receiving openings.

Pan Conveyors—Largest in World

It is natural that the two-unit initial breaking plant should be followed by a strictly two-unit plant throughout, and in this plant the two-unit idea has been carried out with a completeness that has been emulated in only one or two preceding in-

stallations in this country.

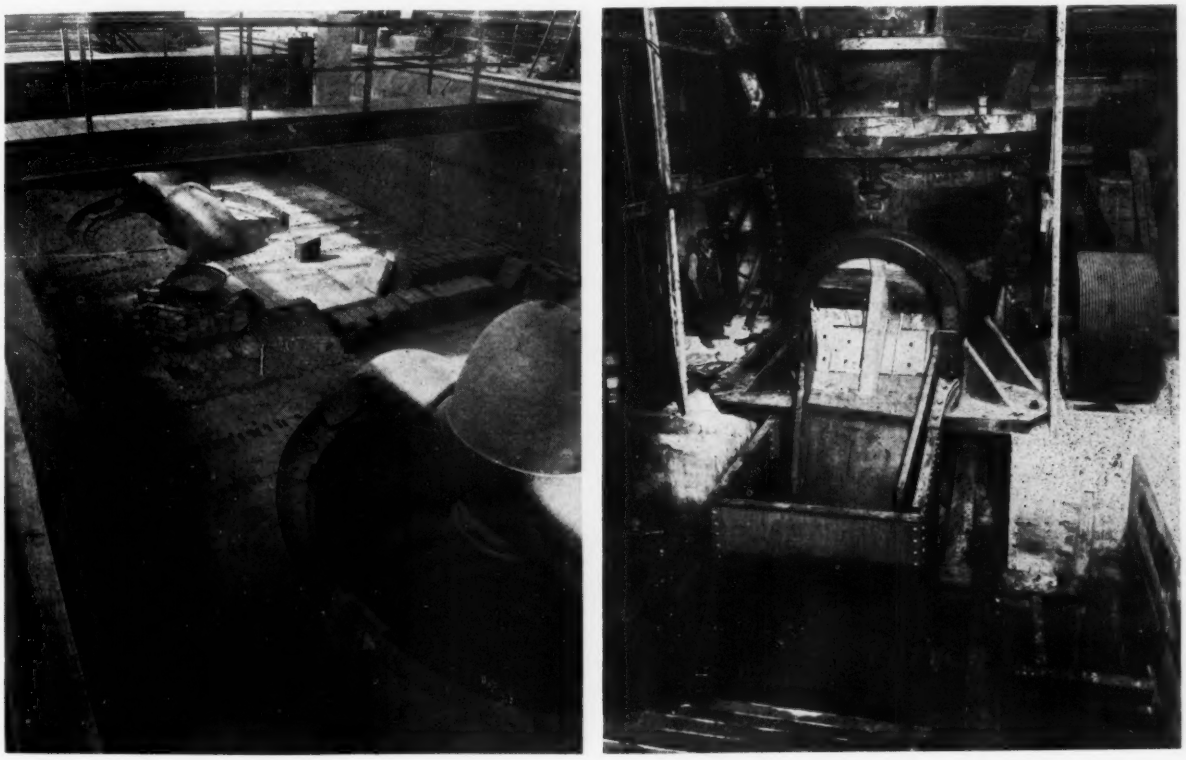
Each No. 24 crusher discharges directly into a 72-in. pan conveyor which carries the material up a 45-deg. incline into the top of the screen house, the head shafts being about 88 ft. above ground level. These huge conveyors are 176 ft. long between centers, a length which exceeds by a considerable margin anything hitherto attempted in pan-conveyor construction.

A feature peculiar to this type of elevator is the great weight of the machine itself as compared to the live load which it is designed to handle. This feature, entailing as it does enormous weight and consequent high chain and head gear stresses, has in the past militated against the use of pan conveyors of over 130-ft. centers.

In order to overcome this objection and to permit the installation of pan conveyors long enough to fit in with the balance of the plant design, which embodied the severe combination of crushers below grade and an extremely high screen house, a most ingenious device has been resorted to in the form of an equalizing device located in the conveyor trestle about 65 ft. below the head shaft. This device is designed to carry the entire dead load of the conveyor up to the point at which it is installed, leaving the upper 65 ft. of dead load, plus the live load, to be carried by the head shaft. This contrivance constitutes "something new under the sun" in pan conveyor design and its conception has made feasible the employment of pan conveyors of a length that was heretofore considered utterly impracticable.

Each pan conveyor is arranged for individual drive from a 200-hp. 720-r.p.m. slip-ring motor through silent chain drive and speed-reducing gearing. Powerful automatic devices are provided on each head shaft to prevent the backing up of the conveyor in the event of power failure when they are under load.

Repairs for the head shaft and driving mechanism will be handled by a five-ton bridge type overhead crane arranged to serve both machines.



The steel-lined hopper in which are the two No. 24 crushers is at the left; the method of setting concaves is shown in the background. At the right is one of the crusher pits, with motor- and rope-drive pulleys at right. The construction of box chute from crusher to pan conveyor should be noted

First Battery of Screens

Each 72-in. pan conveyor discharges directly into two 60 in. by 24 ft. steel-frame closed-end Gates revolving screens arranged in a parallel battery. Each of these screens is geared direct to a 25-hp., 720-r.p.m. slip-ring motor. The first 12 ft. of each screen barrel is fitted with tank steel sections having 3-in. round perforations. Surrounding these sections is a 10-ft. jacket of the same material having 2¼-in. perforations. The remaining 12 ft. of the barrel is fitted with sections built up of scrap steel laid crosswise and riveted at each intersection. These straps are spaced to give a 6-in. square opening. The material passing through these 6-in. perforations, combined with the minus 3 in. plus 2¼ in. material rejected by the jackets will constitute the finished flux and will be chuted to the proper storage bins below the screen rooms.

Second Battery of Screens

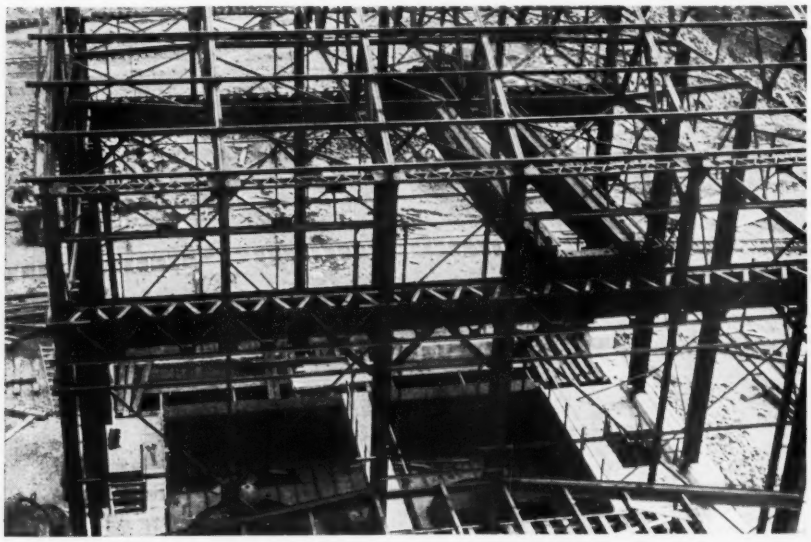
The minus 2¼ in. material passing through the jacket perforations will pass into a second battery of four 48 in. by 20 ft. steel frame closed-end Gates revolving screens below the 60-in. screens. These secondary screens are also arranged for geared drive from four 20-hp., 720-r.p.m. slip-ring motors. It is here that the separation of the various commercial sizes begins. The screen barrels are fitted for their entire length with tank steel sections having 1½ in. round perforations and each screen is equipped with a 10-ft. dust jacket having ⅞-in. perforations. The clean minus 2¼ in. plus 1½ in. and minus 1½ in. plus ⅞-in. size made by these screens is chuted to the storage bins as finished product.

Shaking Screens

The minus ⅞-in. screen passing through the 48-in. screen dust jackets will go to four 5 ft. by 10 ft. double deck shaking

screens. Each of these screens is arranged for individual drive by belt from a 10-hp., 720-r.p.m. squirrel-cage motor suspended from the joists of the 48-in.-screen floor above. Both decks of these shaking screens are fitted with wire cloth, the upper deck having 5/8-in. openings and the lower 3/8-in. Here again the finished minus 7/8 in. plus 5/8 in., and minus 5/8 in. plus 3/8-in. stone is distributed by gravity to the proper bin compartments.

A 20-in. belt conveyor gathers the minus 3/8-in. material from all four screens and discharges it to a second 20-in. conveyor which in turn discharges to a vibrating screen which separates the material into 3/8 in., 1/4 in. and dust, this constituting the final separation into commercial grades.



This construction view of the initial crusher house shows the overhead traveling crane and below the crusher pit and crushers

Secondary Crushers

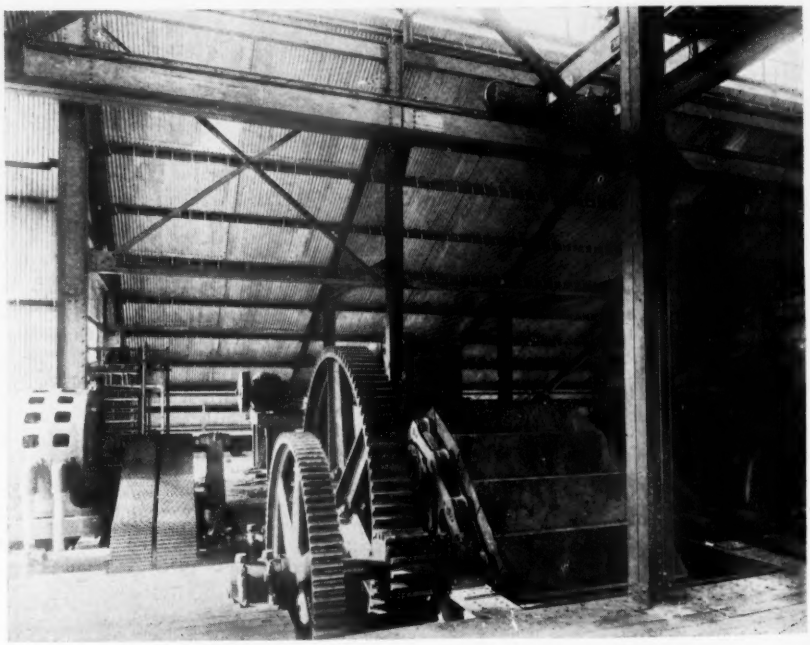
Having followed the commercial screening process through to its conclusion, we will return to the treatment of the oversize material rejected by the initial battery of 60-in. screens.

This oversize product, which will run from 8 to 10 in. in size, will be used for kiln stone for lime manufacture. The Kelley Island company being a leading producer of the latter commodity.

Realizing, however, that the production of oversize will at times exceed the demand, provision has been made for reducing this rock to flux size and under in two No. 8 K Gates gyratory crushers located in the screen house, with their tops 10 ft. below the discharge end of the 60-in. screens. The rejections chutes from these screens are so arranged that the rock can be dropped into the crushers or bypassed to the oversize storage bins, as occasion may require.

The No. 8 crushers are so located that each one of them will receive the rejections from two of the battery of four 60-in. screens. These crushers are belted to 75-hp., 720-r.p.m. slip-ring motors.

A 15-ton crawl over each machine will serve them for repairs and adjustments, the crawl beams being extended outside the building to facilitate the hoisting of heavy repair parts from the ground.



The main pan conveyor, 72-in. x 176-ft. centers, is driven by silent chain and cut-steel gears. The repair crane is overhead, and No. 8 elevator drive in the left background

Elevators

The No. 8 crushers discharge into two No. 8 belt and bucket elevators, 51 ft. long between centers. These elevators pass up between the two pairs of 60-in. screens and discharge into these screens, thus closing the circuit and insuring the reduction of all material to flux size and under when desired.

The elevators are equipped with steel frames and are geared direct to two 20-hp., 720-r.p.m. motors.

Storage Bins

The storage bins under the screen house are divided into 32 compartments having a total active capacity of approximately 4600 tons. The bins span five loading tracks, four of which are equipped with track scales for weighing the cars as they are loaded.

Storage Bins and Weighing

These scales are of the latest design and comply with the requirements of the American Railway Association and the recommendations of the United States Bureau of Standards, providing the most accurate and dependable facilities for weighing cars as they are loaded. The question of accuracy is taken care of to such an extent that customers may feel safe that they will receive the full amount of material for which they are invoiced, thus eliminating the cause of complaints regarding shortages, and the friction between the shipper and the consumer caused by such controversies.

Another deciding factor in connection with such an elaborate system for weigh-

ing was the question of car supply. Car shortages affect all shippers, but none more than the quarry operators. When the railroads of the country were making a drive for intensive loading of equipment, an analysis of car loading was made. This disclosed the fact that cars could only be loaded to full carrying capacity by weighing them as they were loaded, and that by utilizing the full capacity, it was possible to increase the average load to an extent that permitted the shipment of tonnage equivalent to 3200 extra cars in 12 months without asking the railroads to increase the number of cars furnished for loading. This was actually accomplished at the old plant, and inasmuch as the new plant will provide for loading a larger percentage of the total cars on the scales, it seems reasonably certain that even better results toward intensive loading of railroad equipment will be obtained.

An interesting feature in connection with the scale installation, providing for four modern scales, all parallel, is the fact that by means of extension levers all weigh beams are located in a small but well-lighted and convenient weigh house and all weighing will be performed by one weighmaster who will have the four weigh beams within easy reach.

The reader will appreciate the fact that the Kelley Island company has gone the limit in the way of installing equipment that will insure smooth and uninterrupted operation from the quarry to the shipping end.

Arrangements have also been made for loading on a sixth track running alongside the oversize bins, which are the outside row of bins on the side of the building farthest from the crusher house.

The bottom discharge bin gates are all of the scissors type, developed by the Kelley Island company and built in its own shops.

Four 30x30 in. air-operated quadrant bin gates with hinged counterweighted spouts will serve the outside track aforementioned.

All tracks serving the screen house are gauntlet tracks having both standard and 36-in. gage, making it possible to load any product in standard gage cars for rail shipment, or to load in narrow gage cars for any one or all of the following purposes:

Oversize stone to lime kilns.

Any finished product, either to stock pile or to dock for boat shipment.

Fine material to agricultural limestone grinding plant.

Elevated runways are provided from which the car loaders can operate the bin gates and observe the cars from above as they are being loaded.

Buildings

The crusher house, bins, screen house and conveyor gallery are constructed of steel throughout with corrugated siding and roofing.

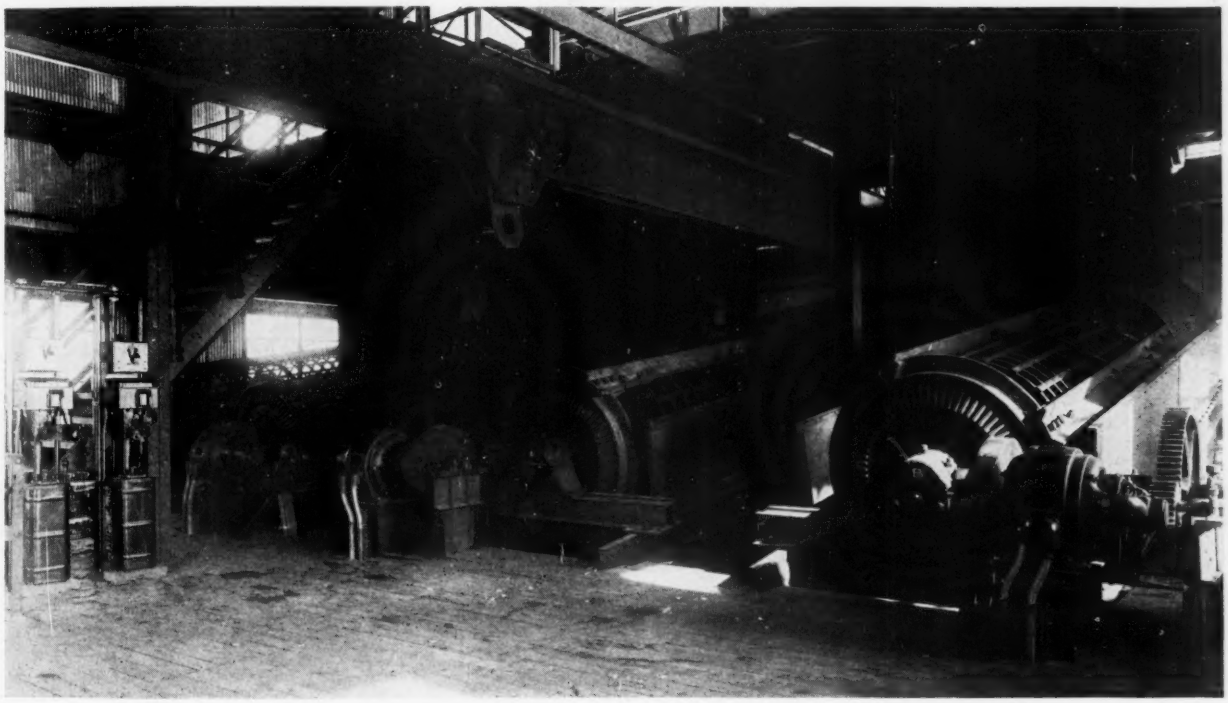
It is believed that this plant will set a high watermark in the provisions made for interior lighting. Large double-window spaces are allowed for in each bay and above each floor, insuring excellent lighting of the interior of the building under all weather conditions. These spaces are fitted with steel sash, glazed with plain glass to permit clear vision over the quarry.

The proportions of the building are generous in every part and the utmost care was exercised in designing the plant to provide ample space around each and every machine for inspection, lubrication, and repairs.

Freight and Passenger Elevator

In this connection it is safe to say that no crushing plant yet erected has as thorough provision as has this plant for handling repairs in a quick and efficient manner. Not only have cranes and crawls been installed over all the heavier machines, but an electrically operated freight and passenger elevator has been put in which will serve every floor in the screen house. This elevator has sufficient lifting capacity to handle repair parts for every machine in the building, excepting only the heavier parts of the two No. 8 crushers. Mention has been made heretofore of the arrangement for hoisting these heavy parts into the building, an operation that will have to be performed very infrequently.

The value of an elevator in a plant of this size and character can hardly be overestimated, and it is safe to say that no



Four closed-end specially-constructed screens, 60 in. x 24 ft., handle the initial screening

piece of equipment in the plant will render a return on the investment more quickly than will this equipment. Not only will it serve to expedite the hoisting of repair parts to the various floor levels, but it will also afford a quick and easy means for the operating men and foremen to get into every part of the building for inspection. This is a feature that has been sadly overlooked in practically all high crushing plants in the past, with the inevitable result that the upper parts of the building are generally unknown regions to the supervising members of the operating crew.

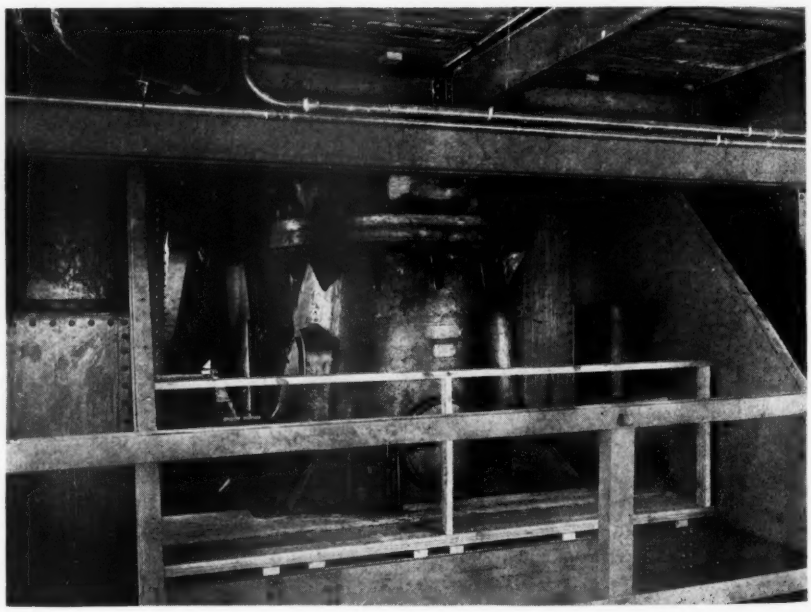
In addition to the elevator, there are stairways reaching every floor and there are also stairways extending along both sides of the pan conveyors. It should also be noted that these pan conveyors are completely housed in from top to bottom. These latter features are refinements which will be envied by those operators who are running pan conveyors erected in the old way on skeleton trestlework with nothing overhead but the sky and nothing alongside but air.

From the steel boxes the stone rolls by gravity into the No. 8 crusher for recrushing

Safety Guards

Unusual precautions have been taken to insure the bodily safety of the men who will operate the plant. Guards made of heavy sheet metal enclose all of the gears and special care has been taken to make these gear guards dustproof. All belts and other moving parts which might be dangerous to the operating crew have been thoroughly guarded. All runways and stairways are equipped with heavy hand rails and toe boards.

Both the screen house and crusher house are constructed with pent houses above the center bay. These pent houses are fitted along both sides with large butterfly ventilators, the idea here being to create an upward air draft through the building which will carry away a considerable percentage of the dust that would otherwise settle on the floors, beams, and machines in the building. The ventilators in the crusher house will also serve to carry away the smoke created by the locomotives as they pass through.



Oversize material will flow down the stepped chutes on either side of the secondary crusher. Electrical conduits for the floor above are placed along the ceiling

Power

That phase of the plant design embracing the electrical equipment has been taken care of with a thoroughness that is rather unusual in crushing-plant construction and the details are interesting and instructive enough to warrant treatment at some length. The feature of individual drive has been carried out to its ultimate possibility.

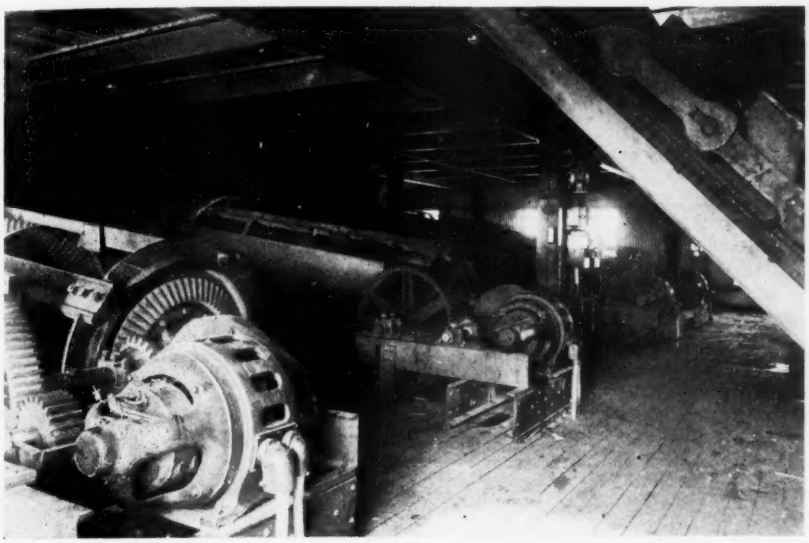
Each and every machine in the plant has its own individual motor and most of those motors are geared directly to the machine which they drive. Belts and rope drives have been used only where their use was essential in order to absorb shocks and irregularities of drive which are inherent in the particular machines for which this type of drive was selected.

In the design of the electrical system throughout, including switching equipment with its protective features, power distribution, etc., the dominating thought was:

1. Safe operation for man and equipment.
2. Economical and continuous production and accessibility of machinery for quick repairs.
3. To obtain graphic record of operations.

Electric power is purchased from a public utility company located 12 miles away and delivered at 23,000 volts, three-phase, 25-cycle, over a transmission line serving this plant individually. This current being

stepped down to 460 volts through three Allis-Chalmers 500-kva. single-phase, oil-insulated, self-cooled transformers installed in a fireproof substation located at one corner of the crushing house adjacent to the pan conveyors. This substation will also house all primary switching equipment, aluminum cell lightning arresters, main switchboard, etc.



Secondary screening is accomplished in these four 48-in. x 20-ft. screens. Motors have enclosed sliprings and direct tight-gear shields. Part of the 72-in. conveyor shows at the upper right

The main switchboard, consisting of the following panels, is so located as to receive the high-tension power, deliver the low-tension power, with a minimum expenditure of copper and offer maximum accessibility for inspection and maintenance:

Panel A, incoming line;
Panel B, feeder circuit for one crushing unit;
Panel B-1, feeder circuit for second crusher unit;
Panel C, feeder circuit for miscellaneous load;
Panel D, feeder circuit for quarry load;
Panel E, feeder circuit for lighting.

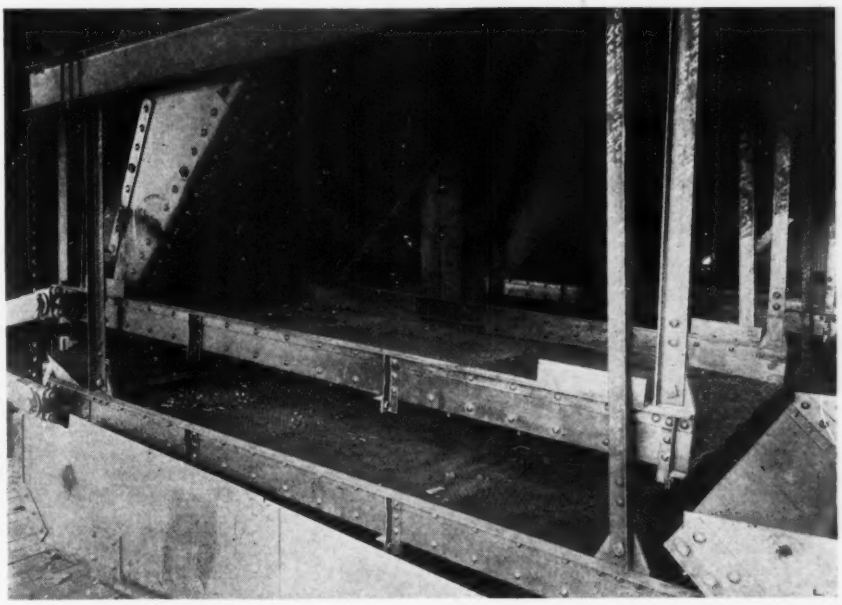
The incoming line panel handles the total power requirement at primary voltage through a remote mounted non-automatic oil circuit breaker. The following equipment will be mounted thereon:

One indicating ammeter,
One indicating voltmeter,
One graphic voltmeter,
One watthour meter (power company's)
One demand meter (power company's).
One watthour meter (owner's for checking).

The feeder panels B and B-1 each control the power to a complete crushing plant unit starting with the No. 24 breakers and ending with the shaking screens.

The third feeder panel controls power to miscellaneous motors, such as the sump pump motors, elevator, air compressor, crane, etc.

The fourth feeder panel controls the power for all quarry use, such as well drills, etc.



These four double-deck shaking screens, individually driven, take out the 3/8- to 5/8-in. and the 5/8- to 7/8-in. material. A vibrating screen separates the 3/8- and 1/4-in., and dust

The fifth feeder panel controls the current for all the lighting circuits.

Each feeder panel has an indicating ammeter and a panel mounted hand-operated oil circuit-breaker with automatic overload trip. The circuit-breakers on the two crushing plant feeder panels are equipped also with automatic undervoltage release; there is also mounted on each of these panels a recording wattmeter.

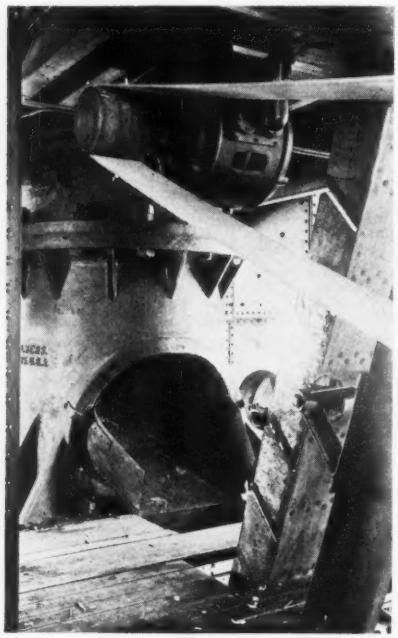
The function of this voltmeter on incoming line panel A is to record voltage variation and to fix the responsibility for any total plant interruption which might be due to low or no voltage, and to record the time and duration of such power outage. Likewise the recording wattmeters on feeder panels B and B1 will record the power consumption plotted against time, of each crushing unit clearly indicating what percentage of the total production of crushed stone was made by each unit. These charts will also tell just how regular the crushers have been fed, the number of times they have been without stone, the period of such delay and the maximum peak of power consumption and its duration. With this information, which can be had daily or weekly, the management has the opportunity of removing the cause of irregular feeding, the possible unbalanced production from each unit and to avoid or cut down those costly power peaks.

All slip-ring motors are provided with a drum-type starter, starting resistance for two-minute service, primary oil switch with automatic overload and no-voltage release, magnetic interlock and indicating ammeter mounted on the oil switch cover. The squirrel-cage motors have potential starters with automatic overload and no-voltage release.

The no-voltage release feature on the oil switches of feeder panels B and B1 and on the individual oil switches for motors serves in addition to its regular function of opening the circuit when power has been dis-

continued the purpose of providing an emergency stop through push-buttons which are conveniently placed at various points in the plant. By means of these push-buttons the plant machinery can be instantly shut down in case of a serious accident to any of the machines or, what is more important in the event of a man falling into the crusher or being caught in any of the moving elements.

The main feeder circuits leading from the sub-station are underground, permitting free and unrestricted passage between the buildings. These main feeders terminate in a junction box under the pan conveyor and from this point the leads are split up going both to the crusher house and screen house. In the screen house, located in the center of the building just above the top of the storage bins, is a distributing board. This



Motors for driving the shaking screens are suspended from upper floor beams

board is of the dead-face type, dustproof, and arranged with switches and fuses on the front. The rear of the board is provided with large doors giving access to sub-feeder terminals, busses, etc. From this board leads are distributed to the various motors in the screen house.

Particular emphasis was given to the safety of the operators and to permit repairs to the electrical equipment without interrupting service to any equipment other than that requiring attention. A disconnecting switch of the enclosed and unfused type is placed ahead of all starting apparatus, rendering that equipment safe to work on.

Full consideration was given to the harmful effects of dust to electrical machinery, and to minimize whatever injury might ensue the slip rings of all motors are fully enclosed, the bearings made dustproof and all oil switches are provided with dustproof covers.

All wire and cable, excepting that which run underground, are rubber insulated, conforming in size to at least the latest requirement of the national electric code. In some applications larger than code sizes are used in order to meet individual requirements.

All wires are run in rigid metal galvanized conduit and flexible conduit connections are used between the rigid conduit and the terminal head of the motors.

Credit for Design and Construction

No expense and no effort have been spared by the officials of the Kelley Island Lime and Transport Co. and those who co-operated with them in the designing, equipping and erecting of this plant to make it modern, efficient and complete in every detail, and the net result of this co-operation is a manufacturing unit that is the last word in rock-crushing plant construction.

The officials of the company whose progressive policy has made this plant possible are:

John A. Kling, chairman, board of directors; Geo. R. Johnson, president; G. J. Whelan, vice-president and general manager; I. J. Sauvey, superintendent of construction; A. C. Schultz, chief engineer.

The plant was designed by the engineers of the Allis-Chalmers Mfg. Co., working in conjunction with the Kelley Island officials. The crushers, pan conveyors, screens, elevators, belt conveyors, quadrant bin gates, transmission equipment and all electrical equipment, starting from the high-tension wall bushings in the sub-station and including the motors and control equipment, were furnished by the Allis-Chalmers company.

The electric cranes in the crusher and screen house were furnished by the Cleveland Crane Co.

The steel buildings were fabricated by the Jones and Laughlin Co., which also made the stress sheets and fabrication drawings.

The erection of the steel work was performed by the Massillon Bridge Co.

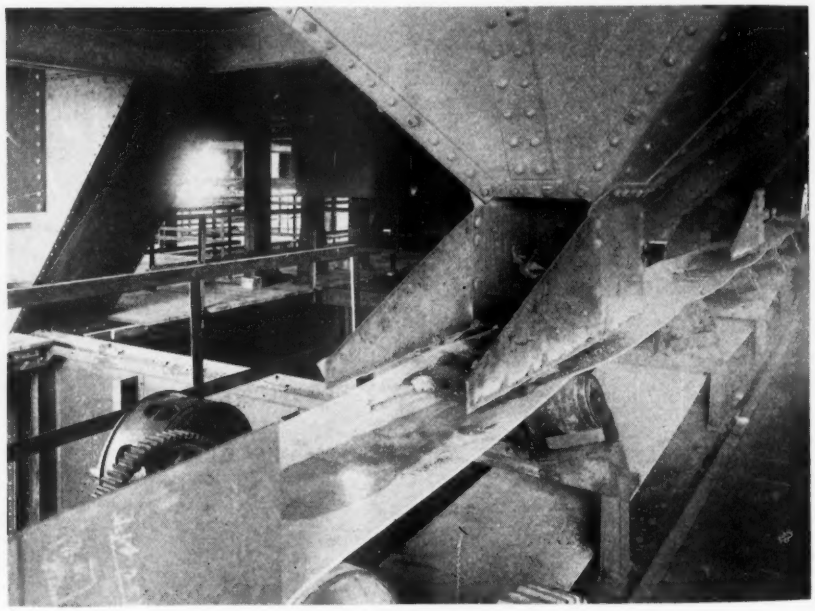
The Standard Scale and Supply Co. furnished the track scales. The freight and passenger elevator was furnished and erected by the Kieckhefer Elevator Co. All electric wiring work was performed by the Dingle-Clark Co. of Cleveland, Ohio.

The foundation work and machinery installation were taken care of by the Kelley Island company's own organization under the direct supervision of Mr. Sauvey and Mr. Schultz.

Erection Problem

Here is an interesting record in connection with the erection of the two No. 24 crushers:

After completion of the crusher foundation, which extends 40 ft. below the quarry floor, the problem of placing the No. 24 crushers was met by the use of a 160-ton railroad wrecking crane owned by the New York Central Railroad Co. In each crusher there are parts weighing 34, 48, and 60 tons respectively. Both crushers were placed in position complete with all bolts entered and nuts started in 17 hr. working time. Credit for this performance is acknowledged to Julius Grossman, foreman of the wrecking crew of the New York Central Railroad, and to I. J. Sauvey, superintendent of construction of the Kelley Island company.



The discharge from shaking screens

The Year's Record for Silica Sand

By F. R. Thrall
Secretary and Treasurer The Geauga Silica Sand Co., Cleveland, Ohio

This industry has suffered practically the same hardships as kindred industries in the past year. Its prosperity depends largely upon the business done by the steel foundries, and with that business showing an increase in the past six months, silica-sand producers are facing the new year convinced that conditions will be much improved

DURING the calendar year 1921 the silica sand industry suffered under the general post-war depression which gripped all business throughout this country, as well as, in fact, the entire world. During the year 1922 the situation improved and shipments materially increased.

As is well known, the prosperity of the silica sand industry depends largely on the business done by steel foundries. While the current year opened with most gratifying prospects, these were seriously affected in the early spring by the coal strike and shortly thereafter by the railroad strike, the combination of the two proving extremely serious. The railroads consume considerably more than half the steel foundry products of the country. The railroad strike naturally withdrew the large purchasing railroads from the market during the greater portion of the year, seriously retarding, therefore, the convalescence of the steel industry, which had been so patiently anticipated in all business circles.

Then, too, the coal strike seriously affected all manufacturing lines, and particularly the steel industry. This misadventure served to accentuate the problems of the year.

Conditions Will Improve

Yet, in spite of these serious handicaps the last six months of 1922 showed considerable improvement over the first six months and December comes with silica sand producers facing the new year with the optimistic conviction that it will bring greatly improved conditions.

The year 1922 has seen very keen competition in prices, with the results which generally attend that condition. One of the bad features of the business during the past year has been the tendency of the users of silica sands to purchase in small quantities for immediate use rather than to acquire a considerable amount and accumulate a stockpile. Of course, it is true that many of the steel foundries, even among the largest of them, do not possess the space which is required for the maintenance of a stockpile of foundry sands, and yet I cannot but strongly impress upon the officials of these foundries that a stockpile is really essential and constitutes for their purposes the protection of an insurance policy against the dangers of delayed shipments, or even no shipments at all, as a result of freezing and inclement weather and embargoes and priority orders by the railroads. In my opinion, the officials of the steel foundries should give serious consideration to the importance of this question.

Advantages of Producers' Associations

In connection with the discussion of the silica sand industry during the past year, I cannot refrain from passing a word of commendation of the advantages of associations among the producers of this product. The advantages of association work are now so generally admitted that it seems quite unnecessary to present any brief in their behalf. The most efficient industries of the country are grouped into associations for the legal and laudable purposes of improving methods of production, marketing, distribution, and the more efficient handling of those legal problems which constantly confront all business men.

Possibly my experience as president of the American Sand Association during the year 1921 has impressed upon me more strongly than upon most business men this advantage of associations. The American Sand Association was organized for the purpose of protecting the interests of the foundry sand producers, both silica and molding sand, in the various traffic and rate problems which have been of constant and acute interest. And scarcely second to these questions has been the matter of improving and standardizing methods of production and systems of cost accounting. This association has religiously abstained from any efforts at price fixing and its success and vitality may be largely attributed to its having avoided any entrance upon this field which is always so fruitful a source of criticism and misunderstanding.

Some Association Activities

Some of the activities of the association during the year 1922 demonstrate such advantages as I have just referred to. In January last the writer, as president of the American Sand Association, in conjunction with Hubert B. Fuller, attorney for the association, appeared before the general committee of the Central Freight Association at Chicago in behalf of an application requesting the railroads to officially recognize the principle that for rate-making purposes *sand is sand.* At this hearing a demonstration was given, by the use of samples of a large variety of sands, to prove the merit of our contention that *sand is sand.* Various decisions were cited for the Interstate Commerce Commission reports affecting other commodities such as brick, coal, ties, etc., where the commission decided articles were entitled to the same general rates without distinction as to the purpose for which they were intended to be used. In short, that the proposed use of an article does not constitute a factor for rate-making purposes.

In Ohio this principle has been adopted and strictly enforced by the Public Utilities Commission in the application of intrastate rates. This matter is of great interest to the users of foundry sands since these sands, by the custom of the trade, are sold f.o.b. quarry. A decision on this application to the Central Freight Association has been held in abeyance pending the decision by the Interstate Commerce Commission in its Docket I. C. C. 13231.

The issuance of Service Order No. 25 by the Interstate Commerce Commission was a serious matter to the sand industry since it cut off a large portion of the available car supply. The American Sand Association went again to the front and succeeded in securing an amendment to this service order by which paragraph 5 of the order was modified to permit the loading of foundry sands in open-top cars suitable for coal when destined in the direction of the mines. This officially recognized the industrial classification of foundry sand with ore, coal, coke, dolomite and fluxstone.

The association has requested the Interstate Commerce Commission to issue instructions to all carriers that in the promulgation of any priorities, embargoes or other orders relating to the distribution of cars and the acceptance of shipments, foundry

sands shall at all times be given the same grading and classification as ore, coal, coke, dolomite and the other ingredients used in the manufacture of steel. These efforts have been primarily advantageous to the large sand users in the steel foundry industry. It is also essential that silica sand be thus handled as it is impossible for the steel mills, who are large users, to store any considerable quantities of this material.

Tendency to Improve Production

There is also a general tendency to improve production all along the line and to use machinery wherever possible, and thus reduce labor costs. There has been brought out a new blast-hole drill for which greater efficiency is promised. The drills for pop shooting have also been improved and portable outfits provided, and mechanical loading is being substituted for hand loading wherever possible.

A very large element in the cost of producing silica sand is that of manual labor. Therefore, whatever appliances are invented, which permit the replacement of manual labor by mechanical devices, will tend to lessen the price of production. The silica sand industry still offers a fruitful and useful field for inventive genius.

The Year in Phosphate

By James A. Barr
Mining Engineer, The International Agricultural Corporation

Production in all lines is on the increase, with better prices, and the foresighted consumer is covering his coming requirements by contract and anticipating shipments to avoid spring car shortages

ACTIVITIES in Tennessee phosphates have been below normal practically all year with the exception of a short spurt in the spring. At present the outlook is much better and production is on the increase.

New Construction Under Way

In spite of the unfavorable times, considerable new construction is under way. At Mount Pleasant the Charleston (S. C.) Mining & Mfg. Co. is rebuilding and enlarging its Arrow Mines plant, used for washing and drying brown phosphates. The company's plans include the addition of a new washing unit, a duplicate of the present washer, which was completed a little over a year ago and which embodied many new ideas in Tennessee practice.

Briefly the company's flow sheet is: Mine cars are dumped on a grizzly and the phosphate washed with a nozzle into a drag classifier, followed by crushing rolls, belt elevators, rotary scrubbers, log washer, rinsing screen and picking belt. The fine phosphate (classifier overflow), locally called sand, is washed in hydraulic jet elevators and concentrating tables and dewatered in Allen cones. A complete new sand washer is being built of steel and concrete and will include an 80-ft. Dorr thickener followed by washing and dewatering cones, designed to recover about 30 tons per day of the very finest phosphate (all 100-mesh) which had been previously sent to tailing ponds. This recovery unit will also be used to reclaim material pumped back from old tailing ponds with a 6-in. motor-driven centrifugal pump.

The balance of the plant is of conventional design and will be constructed mostly of concrete and steel. A 50-ft. span electric traveling crane will serve a wet storage of 10,000 tons capacity and also feed four direct-heat counter-current type rotary driers. A storage shed is being added in which the dried phosphate will be distributed overhead by an electric side dump car and reclaimed by a belt conveyor located in a concrete tunnel running the full length of the shed. The conveyor system will discharge either to a Manierre box-car loader or to the fine grinding unit.

The new dry grinding plant has been designed for a capacity of 2500 tons per month. Most of the old grinding machinery has been scrapped and the new mill is a model of simplicity, the only machinery being two Fuller-Lehigh mills, one elevator and a distributing screw conveyor over a 1000-ton storage bin. The ground rock will be chuted directly to railroad cars.

The old power plant will be junked. The new power station is of brick and steel and will have three 300-hp. water-tube boilers set 10 ft. off the floor to give the large furnace volume necessary for burning high volatile west Kentucky coals. Electric power will be generated at 2300 volts, three-phase, 60 cycles, by a 500-kw. turbine. Two engine-driven units will be used as standbys and a motor generator set will supply direct current. Two triple-expansion condensing plunger pumps will furnish 4000 g.p.m. of water for the new washers.

Will Build Washing and Drying Plant

The American Agricultural Chemical Corp. is building a new washing and drying plant for the treatment of brown phosphates about 12 miles north of Columbia.

The stripping and mining will be done by a Model 36 Marion caterpillar dragline handling a 1¼-yd. Page bucket on a 50-ft. boom. The phosphate will be conveyed to the washer in 4-yd. side dump cars hauled by a 12-ton locomotive.

The washing plant is of novel design, using the Dorr washer, a new machine developed for washing iron ores; it is a combination of a submerged trommel with a standard rake classifier. A Hardinge mill using about a fourth ball load to crush up mud balls will further assist in elutriation of the clay. A Dorr classifier will handle the coarser phosphate sand for final washing and dewatering. All overflows will go to a Dorr thickener or Hydroseparator, which is designed to overflow the clay in solution and settle out the granular phosphate. The underflow from the Hydroseparator will be pumped by Dorco pumps to a bowl-classifier for rewashing and dewatering. The dewatered material as discharged from an elevating drag conveyor will be handled to drainage piles by a clamshell bucket-operating locomotive crane, which will also feed the drained material to two direct-heat concurrent rotary driers. The driers will be fired by Jones automatic stokers. A conveyor and elevator system will either store the dry phosphate in a storage shed or load it direct into box cars with a Link-Belt car loader.

An earth-fill storage dam is being built across a valley to insure a water supply during dry seasons. Two 6-in. discharge triplex pumps will furnish water for the washer. The entire plant will be motor driven, the power being supplied by the Southern Cities Power Co.

A modern village has been laid out in a pleasant and healthful location, to house the employes and operating staff. According to present plans, the work will be completed by the first of the year and the plant will be in operation.

The corporation is conducting extensive research work with a view of improving the present processes and extending the use of phosphate products. The work has included both laboratory and full-size tests on briquetting and sintering of phosphate sand

and is being carried forward rapidly to a conclusion.

Hoover and Mason have completed extensive experiments with a Dorr bowl-classifier, to handle the phosphate sand for final washing and dewatering before sending to the drainage piles. The machine has successfully passed the tests and has been permanently installed in the washer.

Very little development work has been done along the line of prospecting for new deposits. Recently, however, a new phosphate area has been opened up by prospecting between Mount Pleasant and Columbia on the Ridley and Clausen farms, in a section which has heretofore been considered almost totally lacking in commercial deposits. The prospectors report 40 acres as being proven on one farm and 100 acres on another, with the possibility of finding more. The rock is of good grade when cleaned by washing.

In the Blue Rock Field

In the blue rock field the activities for the year have been confined to shipments from existing stocks. Blue rock is, on an average, of lower grade than the brown variety and is naturally first affected by a depression. Some scrap mining has been carried on intermittently, but the output has been small. The stocks at the Mayfield Mines of the Charleston (S. C.) Mining & Mfg. Co. are about exhausted and it is expected that these mines will be reopened about the first of the year.

Ground Rock Industry

The ground rock industry has been practically closed down during the year and only two out of the six plants have operated for short periods. The high freight rates, low prices of other fertilizers and the low purchasing power of the farmer have cut the demand almost to the vanishing point. Producers, however, report an increasing number of inquiries. The Ruhm Phosphate Mining Co. is getting ready to start its mines and plant at once, producing washed phosphate lump from the hydraulic mining and washing plant and ground rock at the grinding unit. The company also contemplates adding a fertilizer plant for the production of acid phosphate.

Fertilizer Makers Move Good Tonnage

The local fertilizer manufacturers moved a good tonnage the past year, but as universal price cutting was the rule the net results hardly resulted in a profit to the producer. The present high price of cotton, which is usually taken as an unfailing barometer of the fertilizer trade, points toward a good business for the coming year. The cotton states are very large consumers and in normal times use a large tonnage to insure an early crop ahead of the boll weevil.

In the Florida field the general production for the year has been from one-third to one-half normal. The low rate of foreign exchange and the domestic depression were the main reasons for the falling off in business. As was common with other industries, several new plants were built during the war and in order to keep these running some tonnage was sold at very low prices. At present, prices have stiffened considerably and prospects are good for the coming year.

The opening of new phosphate deposits by the French in Morocco is viewed with some concern as to the probable effects on the Florida export trade. However, it is now known that the Morocco deposits are spotty and that several knotty problems will have to be worked out before this field will become a competitor.

Florida Fields' Problem

The problems of the Florida field are the recovery of the fine phosphate granules which are screened out with the silica sand and the soft phosphate which is lost with the tailing water and settles in the ponds in lime-putty-like layers. Close attention to screening and replacing the perforated sheets before the slots are worn excessively is the only practical way of improving recoveries.

Classification and tabling have been tried with more or less indifferent results. Electrostatic separation has recently been successful in the laboratory, but it remains to be seen whether this delicate process will survive commercial operation and cost requirements. No practical means have as yet been found and installed for recovering the soft, milky-like phosphate. This is also a serious problem in the hard rock field. The Florida phosphate industry offers rich rewards to any one who can practically increase recoveries and reclaim immense tonnages already stored up in tailing ponds.

The local industries allied closely with rock phosphate are of such interest as to deserve passing mention. The manufacture of ferro-phosphorus has been active and the demand brisk. A large tonnage of this alloy is manufactured in the blast furnace plant of J. J. Gray, Jr., at Rockdale. The process is interesting, consisting mainly of smelting phosphate rock with iron ore and silica in a regular iron blast furnace, using an excess of coke. Furnace control calls for a high degree of skill to prevent freezeups, burn-outs and the production of off-grade alloy.

Mr. Gray completed extensive improvements this year by adding a new stock storage system. Iron ore, phosphate rock, etc., are received on a railroad trestle and dumped over a reinforced concrete tunnel. An automatic scale car runs in the tunnel and gathers the charge ingredients in proper proportions for the blast furnace.

Improvements Made

Improvements have been made in the production of chemically pure phosphoric acid in the electric furnace by the Federal Phosphorus Co. at its Anniston, Ala., plant. The phosphate rock, mixed with the proper proportions of silica, iron and coke, is charged into a specially constructed arc furnace. The phosphorus is reduced, volatilized and collected in Cottrell precipitators. Ferro-phosphorus is also produced, both as a by-product in the acid furnaces and in a specially constructed arc furnace. Continuous, self-baking electrodes are used.

The Victor Chemical Co. has started up its new plant at Nashville for the production of phosphoric acid by the sulphuric acid lixiviation method.

Summary

In generally summing up the year, the entire industry still shows the effects of the passing depression. However, the producers have faith in the immediate future as is evidenced by large amounts of construction work, plant improvements, and research along new lines. The processes are being improved with an idea of reducing costs and increasing recoveries of products heretofore wasted.

At the present writing the production in all lines is on the increase, with demands at much better prices. Stocks at the plants are much lower than this time last year and operation of the washers is still hampered by the low water supply after a long dry summer. Any sudden demands for increased shipments will surely be followed by a sharp rise in prices for spot rock. This condition usually occurs during the spring shipping season.

Foresighted consumers are covering their next year's requirements by contract and anticipating their shipments to avoid the usual spring car shortage.

Limestone Company to Incorporate and Rebuild

IT is the plan of W. E. Snyder, lessee of the Lehigh Pulverized Limestone Co., Allentown, Pa., to incorporate this concern for $500,000 and to rebuild the present plant on the outskirts of Allentown.

According to Mr. Snyder, who is secretary and treasurer and general manager of the new organization, the company will install modern stone-crushing and pulverizing equipment, although no equipment has been selected as yet.

The present plans also provide for a modern brick plant with a capacity of 30,000 brick per day. This unit will consume the greater part of the overburden on the stone which averages from 5 to 12 ft. in depth.

In addition to the brick plant, the company is considering the installation of a lime kiln with a capacity of 12 tons per day. Having crushed stone, sand, lime and brick as its products, the company will be in a position to satisfy most of the wants of local contractors.

Dragline Excavator's Application to Gravel Plant and Quarry Service

By Bradlee Van Brunt
The Bucyrus Co.

Herein is shown when the dragline excavator is profitable; where its use is warranted; when a cleaner product is possible; the advantages of an extremely wide cut; depositing the gravel directly into the hopper; stripping over a rough surface; the excavator's use in quarries—and a bit of history

IT WAS nearly 20 years ago that the first scraper or drag bucket was tried out on the revolving type of excavator. This was on the Illinois and Mississippi Canal in the year 1903. It was not until the construction of the Barge Canal in New York, in 1908, however, that the modern dragline excavator came to be known to the engineering world. Up to this time, canal and ditch excavation, levee construction, and a few isolated cases of railroad work had been the limit of the application to which this machine was put.

The Dominion Sand and Gravel Co., Petersburg, Va., succeeded in loading gravel into cars from two cuts, totaling 240 ft. wide, without moving the loading track with this dragline with a 60-ft. boom. Had a machine with a 100-ft. boom been used it would have been possible to load from a strip about 425 ft. wide without moving the loading track. The machine is about completing a return cut. The mound in the foreground is overburden cast from this cut

A Bit of History

As far as the writer is aware, the first instance of a dragline excavator being installed in a gravel plant was about 14 years ago, in February, 1909, to be more exact. This was a small Monighan machine which was used for stripping and loading sand and gravel in the pit of the Lake Shore Sand and Gravel Co., near Crystal Lake, Ill. About the same time another similar machine was put to work near Plainfield, Ill., in the Joliet Sand and Gravel Co.'s plant.

The non-metallic industry, despite the very marked advantages of this machine, was not at once willing to sacrifice the apparently greater output of the steam shovel for this new and untried device. During the last 10 years, however, this machine, from an adaptation of a light, revolving derrick, has been improved to such an extent that today it is well known that there is no more flexible and generally useful type of excavator built, and in a growing number of cases it is replacing other means of excavation.

Its Outstanding Advantages

Perhaps the outstanding advantage of the dragline excavator for stripping and loading gravel or for stripping a quarry, is its ability to excavate below its own level under water as well as in dry material, taken in conjunction with its extremely wide range of operation, made possible by the full circle swing and long boom. Briefly, then, the flexibility thus made possible by these characteristics of operation is its principal claim for our consideration as a tool for this industry.

Dragline excavators range in size from those with 35-ft. booms to the mammoth machines with booms 155 ft. in length. The tendency in gravel plants and quarries has been to use draglines with booms 35 to 60 ft. in length, and buckets from 1 to 2½ cu. yd. capacity, although a few larger machines with 100-ft. booms and 3½ cu. yd. buckets are in use. This large type dragline apparently has either been considered unnecessarily large for the purpose or too expensive to warrant the heavier investment. Recent experience with the larger machines, however, has clearly proved that this assumption is due to a general lack of appreciation of the mechanical possibilities and the remarkable economies resulting from the proper application of such an installation.

The question as to whether a very large dragline is the proper tool for a property

depends so upon local conditions that it is difficult to give any general rule or to cite any common practice. Ordinarily, however, the most troublesome problem is that of stripping. Stripping, even where the overburden is light, has been found in late years to be economical, as it prevents washing difficulties and the "plugging" of the plant, to mention one of many reasons. There, the theoretical ideal is a machine with as wide a reach as possible, because, as will be told later in citing a specific instance, it is rare that overburden must not be rehandled. This is true because of the impossibility of keeping the loading operations up to the stripping and thus providing an empty pit for the disposal of the waste, as is the case in stripping shallow coal deposits.

Stripping the quarry of the Atlas Portland Cement Co. at Hannibal, Mo., with a Class 24 100-ft. boom. The cut is 100 ft. wide and 10 to 25 ft. deep, consisting of heavy loam, red clay with flinty boulders and a bottom of solid limestone which was handled after blasting

Furthermore, the expense of transporting the overburden to some available waste area ordinarily runs up the cost of production to an excessive figure. Consequently, the dragline must take as wide cuts as possible and rehandle the material cast over, on subsequent cuts, until such a time as the loading machine has provided the empty pit. The limit to the size of machine used in stripping, then, is, as a rule the ability to move easily from one part of the property to another.

Today mobility means caterpillar traction, and the largest dragline now built thus mounted weighs from 85 to 90 tons and carries a 60- or 70-ft. boom. Within this limit, therefore, the size dragline to be installed for stripping purposes depends in the last analysis more strictly upon the relative saving in production costs by sending the gravel clean to the plant, and the cost of stripping. In other words, it is best to install the largest mobile machine that will operate within this ratio.

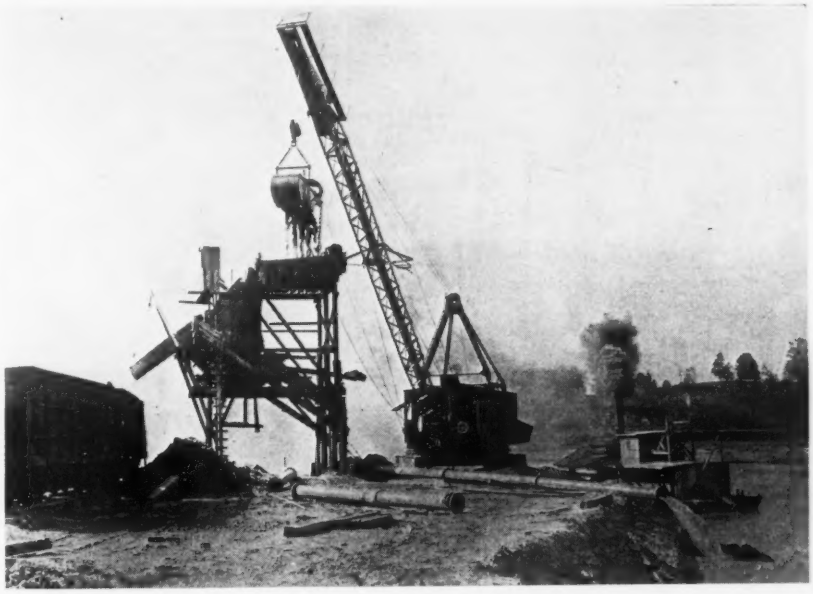
The same general rules govern in the loading of the deposit, except that mobility is not such an important factor and hence there is not this mechanical restriction on size. Here, of course, the capacity required and the depth of the deposit are in general controlling factors. It is not unknown for a large dragline to carry what amounts to a 130-ft. face, 70 ft. above its own level and 60 ft. below, in following down occasional deep pockets of gravel. Another important factor in determining the choice of a large machine is its ability to reach and pick out streaks of clay and pockets of sand from the gravel deposit and cast them aside and out of the way, without the necessity of moving.

An intelligent analysis of the conditions that warrant the use of the larger machine, however, cannot be obtained adequately without studying at the same time the various reasons why the small or medium dragline excavators have established themselves so firmly in the industry.

Conditions Warranting the Use of a Dragline Excavator

Briefly stated, the conditions that appear to have warranted the use of this type of equipment in gravel plants are as follows:

1. Flooded pits.
2. Where selection of materials is important—i.e., when gravel is streaked with tongues of clay or pockets of sand.
3. Where stripping and loading can be done from one setting, or with the minimum of moves.
4. Where an extremely wide cut is advantageous.
5. Where the gravel can be deposited directly into the hopper of a mobile screening plant, thus obviating the necessity of a belt conveyor.
6. Where the contour of the ground is so uneven as to prevent stripping by steam shovel.
7. Where a versatile machine is a controlling factor of economy.



Dragline with 100-ft. boom taking gravel from a river at a depth of from 25 to 30 ft. and dumping it into a hopper 70 ft. above the pit. This simple installation made possible the elimination of an expensive conveyor

A Class 14 dragline with a 60-ft. boom loading concrete gravel into cars from a cut 100 ft. wide and half a mile long. This was taken in the Clem Gravel Co.'s pit at Clem Spur, Texas

the company found itself up against financial difficulties.

In 1915 a Class 9½ dragline excavator with a 45-ft. boom and a 1½-cu. yd. bucket was installed. The pumping machinery was scrapped, the track taken out and the water allowed to rise until it struck a level at from 12 to 15 ft., and the dragline, without moving, loaded from 30 to 40 cars of washed gravel a day. The same condition led, about five years later, to the installation of a Class 14 with a 60-ft. boom and a 2-yd. bucket in a second pit.

Another interesting example of operation under these conditions can be found in England. The pit of the London and Provincial Ballast Co. is on a triangular-shaped island bounded by the forks of a

The Clem Gravel Co., Dallas, Texas, formerly operated this pit with a steam shovel. This dragline excavator enabled them to scrap the pumping equipment, pull the tracks out of the mud and load clean gravel into cars from 12 to 15 ft. of water at the rate of 30 to 40 cars per day

We will go into these seven conditions in more detail.

Flooded Pits

This is perhaps the most obvious reason for the installation of a dragline excavator; where pits are likely to be subject to periodical flooding, where pumping equipment and track troubles eat into profits and where the deposit is in the beds of streams or rivers. This cannot be illustrated better than by citing the case of the Clem Gravel Co., of Dallas, Texas.

The company was organized in 1910 and now operates three pits. One of these pits, at Trinity Mills, Texas, was originally operated by a small revolving shovel, the material being loaded directly into cars as bank run. The difficulties were many. The pit was subject to frequent flooding. Pumping night and day was necessary to keep the plant from floating away. This ate up profits. The track was soaked and buried in mud 50 per cent of the time. Locomotives were constantly jumping the track and breaking rails. The shovel averaged about 10 cars daily. This continued for four years, conditions steadily growing worse until

The J. Fred Smith Gravel Co., Dallas, Texas, formerly operated this pit at Letot by steam shovel. Pumping proved too costly. A dragline with a 60-ft. boom and 2-yd. bucket is now loading gravel under 6 ft. of water at a cost of stripping and loading 50 per cent below the previous cost. Fifty cars of 30-yd. capacity have been loaded in 10 hr.

The Alaska Engineering Commission takes ballast from a river bed and loads flat cars near Nenana, Alaska, with a Class 9½ dragline

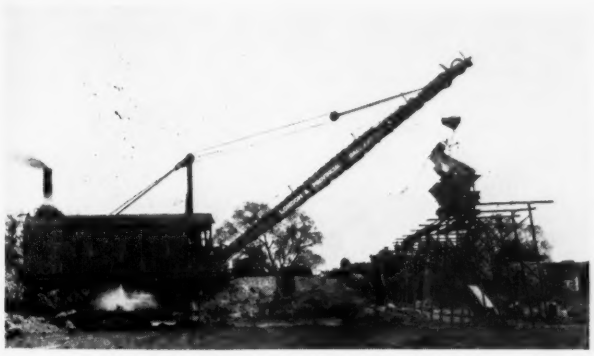
river and a canal. Gravel was loaded into canal boats by means of an overhead railroad on a 15-ft. trestle. The deposit was covered by from 15 to 30 in. of top soil. The level of the water was above the level of the top of the deposit. This rendered it impossible to operate by the usual method of hand stripping and loading employed in that country. A Class 9½ dragline was

The Selection of Materials

Many plants today are using steam shovels for loading and stripping, and encountering the difficulty of "plugging" their washers. Frequently the overburden is taken to the plant with the deposit; furthermore, it is difficult if not impossible to select when pockets of sand or streaks of clay are encountered. The result is that the plant must be closed down periodically in order to clean out the screens, which effectively kills whatever output the shovel is capable of making. Again, the pile of sand beside the plant is meanwhile fast attaining formidable proportions, and presents a problem of disposal that looms large on the operator's horizon.

The dragline excavator is not only an effective cure to such troubles but it makes possible a cleaner product. Perhaps the most striking example of this is to be found in the John Wunder Co. plant in Minneapolis. From 1909 until February, 1921, the material was loaded by a 65-ton railroad-type shovel. The deposit runs from 35 to 80 per cent gravel, the gravel occurring in pockets. The overburden is a clay from 2 to 6 ft. in depth. In the steam-shovel operation this clay overburden caved down with the sand and gravel as the bank was undermined and consequently it all had to be sent through the washing plant, with the attendant difficulties aforementioned.

These difficulties led to the installation of a Class 24 dragline with a 100-ft. boom and a 3½-yd. bucket. This dragline car-



The London and Provincial Ballast Co.'s Class 9½ dragline loading 1-yd. skip cars from a wet pit, on an elevated railroad 20 ft. above ground level. The cars are started down the incline by the bucket and dump their loads into canal barges

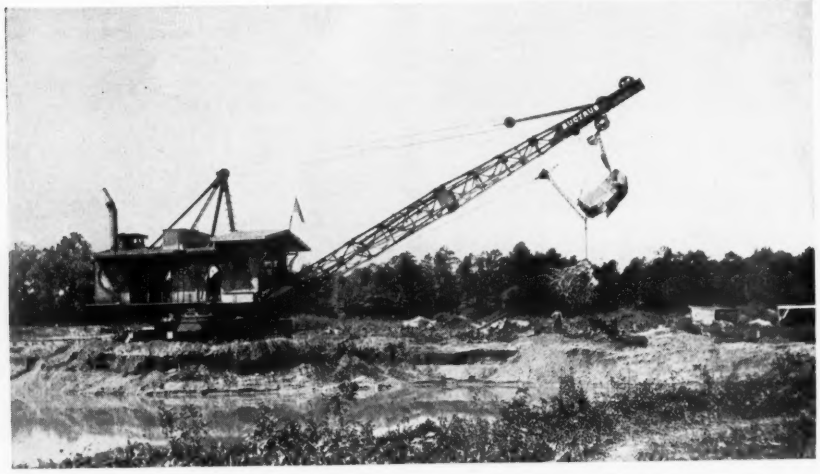
The Van Ormy Gravel Co., San Antonio, uses a dragline excavator with a 45-ft. boom for loading a movable screening and washing plant; the hopper is 26 ft. above the ground. One 20-ft. move is made for every 1000 cu. yd. of gravel

installed. This machine stripped the top soil, throwing it over the bank into the river and without moving dug the ballast, loading it into 1-yd. skip cars 20 ft. above the ground level. Incidentally, this was done without waste, a bucket load to a car indicating how perfectly the machine can spot.

Numerous examples can be cited of operations from banks of rivers. We might mention one instance of a Class 24 with a 100-ft. boom and 3½-yd. bucket which was used for taking gravel out of a river in Indiana from a depth of from 25 to 30 ft. and dumping it into a hopper 70 ft. above the pit. The simplicity of this installation is obvious. No expensive belt conveyor or incidental equipment was required and the great length of the boom gave the operators the range required.

One view of the John Wunder Co.'s operations. The waste material has been cast aside and in the rear of the machine. The pockets of good gravel can be cleaned out without moving the machine

ries a face varying from 50 to 70 ft. in height. (It is well to add here that the normal method of dragline operation is digging below its own level, but in easy-running material no difficulty is experienced in carrying a face of this description before the machine.)

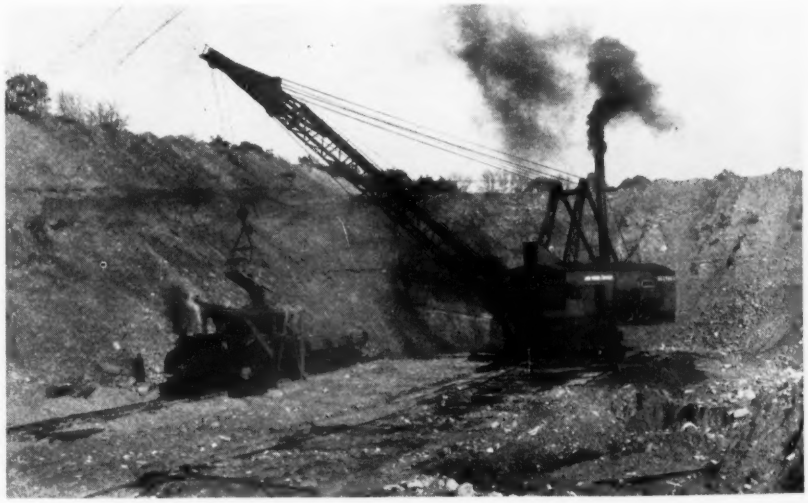


An example of versatility. The Dominion Sand and Gravel Co.'s dragline has just pulled out a stump at 60 ft. from the center of the machine. The cars are loaded with a half-circle swing; 117 cars were loaded at this setting

The characteristic flexibility of the machine enables the operator to pick out the gravel which is loaded through a hopper into 4-yd. Peteler cars equipped with side boards giving a capacity of 6 yd. each. It should be noted here that this hopper is used not because of the inability of the machine to spot its load accurately, as to break the fall of the material on the cars, thus saving wear and tear and incidentally enabling greater speed with less likelihood of spill. When waiting for cars the operator swings to a sand pocket or clay streak, picks out his material and casts it behind him. Here the great reach of the machine is effective; with a good operator this can be as great as 130 ft. or more from the center of the machine. Occasionally a gravel pocket runs down from 40 to 60 ft. below the pit level. The operator can follow this pocket down to the bottom without changing the position of the machine, thus considerably decreasing the wastage of material which is impossible to prevent with a steam shovel or with any other type of excavator. This hole incidentally is filled up with the waste sand by the machine from the same setting.

It must at once be obvious what an ideal method of operation this is and how perfectly the large dragline is adapted thereto.

The stripping problem in any big plant is always troublesome. Mr. Wunder's problem is very much like the case described. He has solved this problem by installing the biggest dragline he could buy on caterpillars to assure complete mobility, a Class 14, with a 60-ft. boom and a 2-yd. bucket. The cuts are taken as wide as possible lengthwise to the property, beginning at the center and working to either side, the material being cast over to one side. Rehandling is obviously necessary on successive cuts. It is also obvious that a time will come, before the property is stripped, when the ridges of overburden on either side of the property will be too big to rehandle again. By the time this happens, however, the large dragline will have completed a cut through this newly stripped property; the stripping machine will then move behind these ridges, cast this over into the cut completed by the large dragline, and proceed with the stripping with little or no delay. The result is a clean product, with no wasteful delay at the plant to prevent a steady output of finished material.



The John Wunder Co.'s Class 24 dragline with a 100-ft. boom and a 3½-yd. dragline, the largest machine of this type installed in a gravel plant. It is carrying a face 50 to 70 ft. in height. The gravel pockets are excavated and loaded into the hopper shown. Streaks of clay and pockets of sand are picked out and thrown into the area already excavated. The deposit is stripped by a caterpillar mounted dragline with a 60-ft. boom. Note a pocket of gravel which has been followed down and cleaned out and then filled up with wasted sand and clay

Stripping and Loading With a Minimum of Moves

In a small or medium-sized plant where separate machines for stripping and loading are not economical, it is naturally extremely desirable to waste as little time as possible on moving the machine from the stripping to the pit and back. Mr. Clem, in the example cited, was confronted by just such a problem before he installed his dragline. He was obliged to cut his shovel out of the pit to get it on to the surface after every third cut. In the process he would lose about 50 cars of gravel. After the dragline was installed it was able to cut a swath of about 60 ft. through the overburden and, without moving or delay, load gravel directly into railroad cars at the rate of from 30 to 40 cars per day.

Advantage of an Extremely Wide Cut

One of the principal advantages in getting a cut of the greatest possible width is the saving in time lost in moving the machine and the prevention of frequent shifting of the loading track. The operation of the Old Dominion Sand and Gravel Co., in Chesterfield county, Virginia, is an extremely good example of this.

The plant is on the banks of a sluggish stream, to which some one has facetiously

given the name of Swift Creek. The land is swampy and the level of the creek varies with the tides. The gravel deposit, which has an average depth of 15 ft., is under water. The overburden is 5 ft. deep. The dragline is a Class 14 with a 60-ft. boom and a light 2-yd. Page bucket.

This is the method of operation: The dragline is carried as far from the bank of the cut previously worked out as possible in order to cast the overburden into this cut; this distance averages about 50 ft. The loading track is placed 60 ft. on the other side of the dragline, measuring from the center of the machine, or 110 ft. from the bank of the previous cut. The dragline strips a cut about 100 ft. wide and loads the gravel lying beneath into 75-ton all-steel bottom dump cars, holding 55 cu. yd. The cuts average 1,200 ft. in length. On the return cut the dragline is again carried just far enough from the bank to permit it to cast into the previous cut. Cars are loaded on the same track. A section of this track is taken up with each move of the dragline and swung to the next position. The dragline moves up in 40-ft. jumps. The cut this time is 140 ft. wide as it is simple for a good operator to throw the bucket for the extra width. It is thus possible to load the entire width of two cuts, about 240 ft., without shifting the loading track. Incidentally, 150 75-ton cars have been loaded to one move with gravel 20 ft. deep, and a car (55-yd.) has been loaded in 8 min. with 34 swings.

It is interesting to observe here that had a dragline with a 100-ft. boom been used instead of one with a 60-ft. boom the width of about 425 ft. could have been handled without moving the loading track.

In the Crystal Gravel Co.'s installation at Burley, Idaho, this small dragline with a 42-ft. boom strips the overburden and casts it aside in ridges as shown and loads the clean gravel into cars; if road material is required it gets the proper mixture of top soil and gravel. It moves the track under its own power 75 ft. to a new location when the gravel is exhausted. It spots and moves fifteen 110,000-lb. capacity loaded cars at once by block cable and has loaded forty 40-yd. cars in 13½ hr.

Depositing Gravel Directly Into Hopper Without Use of Belt Conveyor

In many plants of permanent and semi-permanent nature, the dragline frequently is effective in realizing a considerable saving by reason of its ability to dump into a hopper to a great height above the ground, and thus obviate the necessity of a belt conveyor with its attendant expenses of upkeep and operation.

A good example of such an installation is illustrated herewith. The plant is that of the Van Ormy Gravel Co. of San Antonio, Texas, located at Van Ormy, 15 miles south of San Antonio.

The equipment consists of a Class 9½ dragline excavator with a 45-ft. boom and a 1¼-yd. bucket and a movable screening and washing plant in one unit, mounted on skids and rollers. The screen, driven by a 30-hp. gas engine, has a capacity of 50 cu. yd. per hour and separates into four sizes. The water for the washer is pumped by centrifugal pumps driven by a 16-hp. gas engine.

J. P. Nelson, San Antonio, found it necessary to make repairs on his screening plant. Without moving his dragline from its digging position the screen was lifted and held while repairs were made and was then replaced. The load was under control at all times

The hopper is 26 ft. above the ground; the boom is set at an angle of 45 deg., enabling the bucket to clear the hopper easily and at the same time carry a cut 75 ft. wide. The plant turns out 15 cars of gravel per day, with the dragline never working to capacity. The plant is ordinarily moved 20 ft. for every 1,000 cu. yd. of gravel excavated. This is accomplished by means of a snatch-block and cable, the end of the cable being attached for the purpose to the dragline bucket.

Stripping Over a Rough Surface

There are, perhaps, more than a dozen different methods employed for stripping overburden from a rock and gravel deposit. These differ greatly with the varying conditions prevailing. It is safe to say, however, that there is no phase of the quarry problem which better warrants study and which offers a better opportunity for cost-cutting. Of the various mechanical means of removing overburden, the steam shovel is perhaps the most common; whether it is the proper tool depends entirely upon conditions, but there is one condition in particular where the dragline, particularly of the smaller size, is unquestionably superior. We speak of the property with an uneven contour or rough surface. This is particularly apparent in some limestone quarries.

The characteristic operation of the dragline is ideal for such a condition; it works from the original ground level, backing away from the excavation; it can fill in or level off its own path in advance if necessary; it can strip the rock or gravel clean following the overburden down into pockets; it is mobile and easily handled, especially when mounted on caterpillars.

An accompanying illustration shows a 1-yd. gasoline dragline employed by the Bethlehem Steel Co. for stripping its Bethlehem quarry. The property was just as described, hilly, rough ground with an uneven deposit. The machine replaced a small shovel formerly used for this purpose.

Versatility of the Excavating Machine

Finally, versatility! We have said that

there is no excavating machine yet produced which is more flexible and more versatile. This characteristic is of extreme value to the rock and gravel producer. We have shown how it can dig far below its own level, or carry a bank above itself; how it can dig as easily under water as in the dry; carry extremely wide cuts; pick out waste material from the deposit and dispose of it without rehandling, or serve as the means of moving its own screening plant. But there are still other purposes to which it can be put which often lead to great economies.

It is frequently used to tear up stumps and clear property ahead of itself, thus obviating the necessity of extra labor or equipment for that purpose. As a crane it is often invaluable for many purposes, such as making repairs on the screening plant, shifting loading track or spotting cars, all from its digging position.

Out in Southern Idaho the Crystal Gravel Co. of Burley found this out. This district is the center of a large and rapidly growing irrigated area. Gravel was in tremendous demand, but the nature of the deposits was such as to forbid the use of a stationary plant. Gravel was loaded directly on cars without screening. Teams and fresnos with belt conveyors were found to be uneconomical and other devices were expensive and time consuming, when it came to moving them to new locations, which had to be done frequently. A dragline with a 42-ft. boom and a 1¼-yd. bucket solved the problem.

When a train load was required for concrete purposes this machine stripped the overburden and loaded the gravel in the cars; when it was needed for road material it automatically got the correct mixture required of top soil and gravel. When the pit was worked out the track was moved 75 ft. from its former location by the machine, thus solving a big problem that had previously worried the management.

Fifteen loaded cars of 110,000-lb. capacity each were spotted and moved with the machine from its digging position by means of a cable, one end of which dropped over a bucket tooth. And on top of all this an easy average of 2½ cars per hour —somewhat over 118 cu. yd.—was maintained and as high as 40 40-yd. cars in 13½ hr. were loaded. Quite a variety of achievements for one digging unit!

Before we leave this point of versatility, it should be emphasized that the bucket is so easily controlled that it can load cars of large or small capacity as nicely as a steam shovel and with far less spotting necessary to get the cars under the load. Furthermore, it is important to note that the smaller and many of the larger sizes of draglines are so designed by most manufacturers that they may be quickly and easily converted into steam shovels or cranes by the substitution of the proper boom and bucket, a task which can be done in the field.

Where a small dragline is effective in stripping a limestone quarry over a rough surface and hilly ground. A 1-yd. gasoline operated machine in the Bethlehem Steel Co.'s Bethlehem quarry

For Quarry Service

Nothing has been said about the dragline as a tool in a quarry other than for stripping. Although this machine, when put up against it, has acquitted itself remarkably well in handling blasted rock, it is not the tool to use except under very unusual conditions. There the steam shovel occupies an undisputed superiority, principally because of its great power delivered to a rigidly connected dipper. Manufacturers do not recommend the dragline for quarry service, but when put up against it this machine has accomplished wonderful feats in the hands of competent operators.

To cite but one instance of this: During the construction of the Huffman Dam on the Miami Conservancy District near Dayton, Ohio, a Class 24 electric dragline handled 25,000 cu. yd. of rock at one setting. The problem was the excavation of a very confined area in solid rock; the maximum width of the excavation was 220 ft. and the depth 65 ft. All rock was drilled and blasted and then handled by this machine. Of course such a condition is unusual, but it is mentioned to illustrate what this machine can accomplish if properly handled.

It is a question, in spite of the growing use of the dragline excavator in gravel plants, whether its true value is generally and thoroughly appreciated in the industry. Many older plants are indeed saddled with costly equipment which could only be replaced with a modern dragline installation at a considerable sacrifice. But it is quite evident that in many instances such a sacrifice could easily be converted into a really profitable investment if the economies thereof could be clearly visualized.

Alpha Portland Buys Continental Plant

THE cement plant of the Continental Portland Cement Co., located at Continental, Mo., has been purchased by the Alpha Portland Cement Co. of Easton, Pa.

In addition to a consideration of $1,000,000 in cash, the Alpha company has assumed the Continental's indebtedness of $1,500,000. The outstanding payment of $1,000,000 in cash will be made to 400 Continental stockholders.

The Alpha company announces that it intends to expand the operations of the Continental plant and that it will increase the present output of 3200 bbl. per day to 4500 or 5000 bbl. The new owners plan to spend over $500,000 in remodeling and enlarging the operation.

Almost immediately after the Alpha company acquired the operation, a suit was filed in the local courts asking a permanent injunction to prevent the quarrying of rock at the Continental quarries and to prevent the spread of cement dust over the surrounding country. In the suit it is alleged that over 4000 residents within a radius of 2½ miles of the plant are affected by the frequent blasting. These residents claim that the blasting causes the breaking of windows; shaking and damaging of houses; breaking and damaging of cisterns and water systems, and that the spread of the cement dust menaces and endangers their lives and health.

The company has not answered officially, but it is probable that it will be necessary for it to change from the open-face quarry method to a mining operation. It is also likely that the company will have to employ the use of a dust-collecting system.

Gypsum Industry's Growth in 1922

About 75 per cent of the gypsum mined is represented in plasters. Many new plaster-mixing plants organized, especially in the East. The Canadian companies have made great strides. From present indications, the total gypsum output this year will exceed 3,000,000 short tons. The coming year promises its increasing use

By Virgil C. Marani
Chief Engineer the Gypsum Industries Association

THE gypsum industry records a steady growth during the year past, and from present indications, the total output for all purposes during 1922 will be more than 3,000,000 short tons.

The use of gypsum tile for non-bearing fireproof partitions, stairway and elevator enclosures and the protection of steel columns, girders and beams, has increased to an extent sufficient to justify the construction of new plants and machinery at the manufacturers' mills. With these new facilities for manufacturing gypsum tile, the total output is still, in some localities, short of meeting the present demands. In some instances the machines to manufacture gypsum tile have been remodeled and improved so as to increase their capacity and turn out a more perfect tile or block.

Gypsum tile are manufactured to comply with the "Standard for Gypsum Block" requirements, as set forth by the Underwriters' Laboratories, Inc., and in all respects the consumer is assured a product suited to the purpose intended and of standard chemical and physical properties.

Advances in Building Construction

Similar advances are noted in respect to the use of gypsum plaster board and gypsum wall board in building construction. Gypsum plaster board, recognized as an incombustible lathing material, is in great demand for non-bearing incombustible partitions in fireproof construction when secured to metal supports and covered with gypsum plaster. More recent uses of gypsum plaster board include suspended ceilings, insulation and fire protection. This material is also being used upon the roof boards and under wood shingles, and between the wood sheathing and finished siding for fire protection purposes and insulation.

The scarcity of plasterers has contributed to a substantial increase in the use of gypsum wall boards which constitute an interior wall, ceiling and partition finish for all types of buildings. The popular desire for an interior finish of this character which is incombustible has necessitated provisions for a greater output and a standardized product. Manufacturers of this product have increased their plant facilities, and have included such mechanical changes in the machinery as will assure a product of uniform strength and thickness. Gypsum boards are manufactured to meet the fire test and requirements of the Underwriters' Laboratories, Inc., and in conformity with the strength and dimension specifications of the American Society for Testing Materials.

Building construction economies, which involve consideration of "dead load" to be provided for, rapid erection, quick setting, etc., have contributed to the prevailing use of reinforced gypsum in the construction of fireproof floors and roofs. The improvements during the past years in this type of construction are noticeable in the character and method of reinforcing, a more dense and uniform product and, in the case of pre-cast structural tile or slabs, joint details which assure more satisfactory results and provide for any unequal spacing of the steel supports.

More recent developments in the use of gypsum for floor or roof construction in one instance involve the use of standard rolled steel sections designed to carry the full load. The construction is completed by attaching pre-cast reinforced gypsum slabs on top to form the floor and below for the ceiling.

Another new roof construction consists of steel supports between which a gypsum plaster board is set (as a form) over which the reinforcement is placed, the whole being covered with the gypsum, which is poured-in-place. The plaster board form is not removed. The importance of gypsum floor and roof constructions, aside from the fire protection afforded, lies in the weight, which in some designs is only 48 lb. to the cubic foot.

Increased Use Due to Better Knowledge of Its Properties

A better knowledge of the chemical and physical properties of calcined gypsum has made possible the use of gypsum, in the form of tile, as a void filler in combination systems in which reinforced concrete T-beams are designed to carry the full "dead" and "live" loads. The light weight of gypsum permits the use of a larger void filler than usual and, consequently, greater spacing of the concrete beams. In work involving about 50,000 sq. ft. or more it is practicable to cast the gypsum tile on the job.

During the past year about 76 per cent of the total gypsum mined is represented in gypsum plasters of various brands. The increased use of this plastering material has encouraged the formation of new concerns located in Phoenix, Ariz., El Centro, Calif., and Alamogordo, N. M. Many new plaster-mixing plants have been organized, these activities being more pronounced in the East.

Recent tests at the Underwriters' Laboratories, Inc., have resulted in approval for a one-hour fire protection rating for gypsum plasters upon a woven wire or expanded metal lath base. A similar approval has been given by the Western Actuarial Bureau, which accepts gypsum plaster wherever a "cement" plaster is mentioned or required in the rating schedules.

Efforts are being made to further extend the use of gypsum plaster by improved grinding after calcination which results in a product of greater plasticity. Three gypsum plaster manufacturers are already successfully producing and marketing a plastic gypsum plaster. Technologic Paper of the Bureau of Standards, No. 181, deals with a practical but not yet popular method of obtaining color effects by including in the plaster wood fiber which has been stained to obtain certain predetermined results.

Great Strides in Canada

The Canadian gypsum companies have made great strides in the construction of dwellings with outside bearing walls constructed with gypsum tile. Houses of this type have been erected in Toronto, Montreal, Paris, and other localities in Canada. Another advance by the Canadian manufacturers is the ready-cut steel frame house which is covered inside and out

with gypsum plaster boards. The exterior of these buildings is protected with portland cement or magnesite stucco applied to chicken wire or a light metal lath. In the case of the cut-steel house the floo and roof are of gypsum, providing in such cases a fireproof and economical dwelling.

Canada has also pioneered in the use of gypsum plaster board for roof construction. A large skating rink in Paris, Ont., is entirely enclosed with plaster board, the roof consisting of wood stripping spaced to accommodate the application of two layers of ⅜-in. thick gypsum plaster board over which is applied the roof covering to protect the plaster board from exposure to the elements.

Its Use for Insulation Purposes

The use of gypsum for purely insulation purposes is being fostered by American enterprise. A new, economical and practical process consists of introducing into the calcined gypsum when mixing certain chemicals in powdered form up to a possible seven per cent of the bulk. The resultant chemical action just prior to the setting period causes the mass to increase from two to three times its original bulk, yielding an extremely porous material of cellular formation which, according to the amount of chemical used, can be made to weigh as little as 9 lb. to the cubic foot. Because this material sets quickly it can be poured in place, or in forms, for the purpose desired. The logical field for this material will be the insulation of dwelling-house exterior walls and the ceilings and attics.

The Gypsum Industries Association maintains a Fellow on gypsum at the United States Bureau of Standards. Through this connection it has been possible to develop information of an authoritative character dealing with the following:

Specifications for gypsum plasters upon concrete surfaces
The use of anhydrite gypsum in the manufacture of portland cement
The use of gypsum mortar for interior masonry load-bearing construction
Standard specifications for a gypsum plastering sand
Colored wall plasters of gypsum
Plastic gypsum plaster (U. S. Patent No. 1392574, given to the people of the United States)

The Bureau of Standards is also conducting researches involving the following:
Determination of the cause and prevention of efflorescence of gypsum
The integral waterproofing of gypsum
The sound conductivity of various kinds of plastered surfaces upon standard types of partition construction.

No less important than the work of the Bureau of Standards are the activities of Committee C-11 on Gypsum of the American Society for Testing Materials. This society has in operation standard specifications for gypsum plasters (Serial Designation C-28-21) and for calcined gypsum (Serial Designation C23-22). The tentative specifications, which later will become standard, embrace the following:

Tentative specifications for gypsum (C22-22T).
Tentative specifications for gypsum plastering sand (C35-21T).
Tentative specifications for gypsum wall board (C36-22T).
Tentative specifications for gypsum plaster board (C37-22T).
Tentative methods of testing gypsum and gypsum products (C26-21T).
Tentative definitions of terms relating to the gypsum industry (C11-22T).
Tentative specifications for gypsum partition tile (to be submitted).

Gypsum as Plant Food

Agricultural gypsum, or land plaster, which is the native rock crushed or ground to suitable size, is being more extensively used for the purpose of supplying the two essential plant foods, calcium and sulphur. In this form gypsum is used as a crop food for alfalfa, red clover, and other crops of high sulphur requirement; also as a preserver for manure and as an amendment for black alkali. It is also being used in combination with ground rock phosphate as a substitute for acid phosphate.

The increasing use of agricultural gypsum for soil fertility purposes is the result of educational work being conducted by county agents and through fellowships recently installed and being maintained in the following institutions:

Iowa State College, Ames, Iowa; University of Chicago, Chicago; Cornell University, Ithaca, N. Y.; North Carolina State College, Raleigh, N. C.; Kentucky State University, Lexington, Ky.

The chemical uses of gypsum in the manufacture of many essential and commonly used products has increased with the general prosperity of the country. However, more than 95 per cent of the tonnage produced is converted to the manufacture of gypsum plasters and fireproof building products. The coming year promises a still greater demand for gypsum in these forms.

Good Roads Congress

A MOVEMENT likely to result in the enactment of uniform highway traffic regulations throughout the country is expected to develop at the approaching thirteenth American Good Roads Congress and fourteenth Good Roads Exposition, to be held January 15 to 19, in Chicago, under the auspices of the American Road Builders' Association. This subject is agitating the entire field of highway transportation and development at present and the indications are that it will be brought to a head through a proposal by President T. J. Wasser of the road builders' organization in his annual address on January 16.

Mr. Wasser will propose joint action by the American Road Builders' Association, the American Society of Automotive Engineers, the American Automobile Association, the National Automobile Chamber of Commerce, the American Association of State Highway Officials and the United States Bureau of Public Roads and possibly other agencies, with a view to working out a solution of the question along national lines.

Eighty-five thousand invitations have been sent to state, county and city officials, highway contractors, engineers and good roads advocates generally. The mayors of 5000 American and Canadian cities and 3000 county boards have each been asked to appoint five official delegates to the congress. Each exposition room has been applied for at the show to fill much more space than can be secured in the Chicago Coliseum and adjacent buildings. Excursion rates for the round trip to Chicago have been granted by all railroads.

During the congress, conventions will be held in Chicago by the Asphalt Association, the Midwest Section of the American Association of Engineers, the National Sand and Gravel Association, the National Crushed Stone Association, the Illinois Highway Contractors' Association, and the Illinois Association of General Contractors.

The entertainment will include a stag party to be given by the exhibitors, with orchestral music, songs, dancers and boxing contests. On January 17, the annual banquet of the association will be held at the Congress Hotel. Men of national prominence will address the banquet and a high class musical and vaudeville program will be rendered. On January 18 the association will entertain delegates and visitors with a dinner-party at Terrace Garden, during the performance of "The Terrace Garden Review."

SAND AND GRAVEL CONVENTION

THE seventh annual meeting of the National Association of Sand and Gravel Producers will be held at the Raleigh Hotel, Washington, D. C., January 24, 25 and 26. A real program has been arranged and will soon be made public. All members are urged to attend as this convention will afford some treats that only the Capital City can offer.

Sand and Gravel's Part in the Past Year's Progress

By Alex. W. Dann
President, The National Sand and Gravel Association

THE new year is a time when we pause to look back a while—and then look forward. This review and forward glance from a business standpoint is especially appropriate for those of the sand and gravel industry, since the coming of the cold weather closes down many producing operations and leaves the operator nothing much to do until spring except to count over his last year's business and plan for the coming of another season.

The Transportation Situation

The transportation situation stands out perhaps more definitely than any other influence on the sand and gravel business in 1922. It is too early to estimate the tonnage sold as compared with other years, but it is true that it did not approach the possible figure had there been a fair freight rate adjustment to facilitate procuring orders and an even chance to secure cars in which to ship the orders on the books.

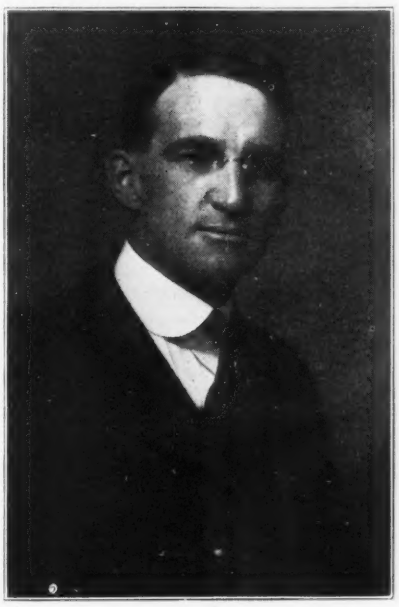
It has been expressed by some that the freight rate issue is a lost cause and that our commodities must continue to pay so much more than their share of the transportation burden. We fail entirely to agree with that view.

In 1922 it is true that we gained but few reductions in spite of a hard fight, but we believe that transportation charges on sand and gravel must come down. This will be because it is fair; because the organized industry insists upon it, and because the carriers must soon again really want the business of carrying these commodities. When they reach that point good business will prompt them to take steps to retain or to win back this transportation revenue which has been lost to them due to high rates.

All recognize that there is a severe shortage of transportation facilities, but the matter of priorities and unequal division of those facilities has awakened a strong sense of injustice done in the minds of those dependent upon open-top (not coal) cars for marketing products. Priorities, except in a very limited sense, or in case of war or real or impending public disaster, are wrong and unfair. We hold that every industry is entitled to its fair share of transportation—and no more. And further, we have yet to find or hear about a railroad operator who will admit of any assistance given him toward distribution of coal by reason of the priority orders.

It is not hard to imagine the glow of satisfaction over a deed well done which must have flowed over the Interstate Commerce Commission when the priorities were lifted a short time ago. But this deed found the road work closed down, with the concrete mixers and mortar boxes in winter quarters. In most cases we venture that it found the producers uninterested because the orders were few and the season over.

> ***"IT SEEMS to us that our association made progress in 1922, part of which was advocating better cleaning and grading of materials and promoting their use; seeking a better and fairer deal in transportation matters, and working out a better organization and larger membership of interested companies, to which companies there has been rendered an increasing amount of service."***



President Alex. W. Dann of the National Sand and Gravel Association

We could use very strong words and yet fail to express the feeling of our industry concerning the priority orders. We believe it wrong that one body of men should bear such responsibility and authority. We would limit the powers of the Interstate Commerce Commission and we cannot see how the unjust and unfair priority system can be maintained even with such able and consistent backers as the Coal Association.

A Good Cost Record Would Reveal a Lot

Of course our industry finds a measure of its prosperity in the well being of those whom it serves. We are advised that the producers serving rural and farming commodities did not have a good season because the farmer was selling below cost and could not buy. The farmer cannot help himself (until he is better organized), but in our industry we believe a good cost record would reveal a lot to many producers.

We feel more and more that the National Sand and Gravel Association has a very definite and proper field of activities. With the trend toward centralized control in Washington of the Nation's activities, our industry must be united to protect its proper interests, a protection which the individual is powerless to secure.

It seems to us that our association made progress in 1922 in this proper field, part of which was advocating better cleaning and grading of materials and promoting their use; seeking a better and fairer deal in transportation matters and working out a better organization and larger membership of interested companies to which companies there has been rendered an increasing amount of service.

Would Produce Cheap Fertilizer at Muscle Shoals

REPRESENTATIVE DICKINSON, Republican farm bloc leader from Iowa, has recently introduced in the National House a bill proposing government manufacture of fertilizer at Muscle Shoals, Ala., for sale at "the cheapest possible rates" to farmers.

It is Dickinson's plan to have the government set up a corporation consisting of the Secretaries of War and Agriculture and three other members appointed by the President.

The Slate Industry

By Dr. Oliver Bowles

The stagnation of this industry, due to high percentage of waste and keen competition from other products, is gradually being overcome. In its varied forms the slate industry has entered upon a period of broader attainments and greater prosperity

SLATE originated from clay or shale through the intense pressure exerted by geologic forces within the earth's crust. Such pressure resulted in a recrystallization of the original constituents so that practically no clay remains in a high-grade slate. As a result of the pressure, the flakes of chlorite and mica, two of the most important new constituents, have assumed a parallelism that results in the characteristic property known as slaty cleavage, a tendency to split with ease into thin sheets with smooth surfaces. The direction of slaty cleavage bears a definite relation to the direction of pressure that caused it, and is quite independent of the original bedding.

Uses of Slate

Slate consists of insoluble and stable minerals and this, together with its peculiar splitting property, makes it useful for many purposes. Originally it was used chiefly for roofing, but other uses have gradually developed until today scores of slate products are on the market. The chief uses are for roofing, blackboards, school slates, electrical switchboards, grave vaults, shower stalls, baseboards, floors, steps, billiard tables, walks, and other structural and sanitary products.

Development of the Industry

The use of slate for roofing in France and England dates back for hundreds of years. Roofing slates were first made in America in 1734, and early in the nineteenth century the industry was firmly established on this side of the Atlantic. During 1922, slate—not including granules—was quarried in five localities: Lehigh and Northampton counties, Pennsylvania, the most productive region; the Fair Haven-Granville district of New York and Vermont; the Peach Bottom district at the Pennsylvania-Maryland border; the Arvonia, Virginia district and at Monson, Maine.

Pennsylvania slate is used chiefly for structural, electrical, blackboards and roofing; the Fair Haven for structural, electrical and roofing; Granville and W. Pawlet slate for roofing; Peach Bottom and Virginia slates almost entirely for roofing, and the Maine slate almost exclusively for electrical switchboards. There is some prospect of production from two new localities in 1923—Provo, Utah, and Fairmount, Georgia.

Its Slow Growth

As indicated by the following table compiled by the Geological Survey, showing sales for a series of years, the growth of the industry has been very slow:

SLATE SOLD IN THE UNITED STATES, 1917-1921, BY USES

	Roofing slate			Mill stock				
Year	Squares (100 sq. ft.)	Value*	Average value	Sq. ft.	Value*	Average value	Other uses†	Total
1917	703,667	$3,411,740	$4.85	10,663,000	$1,799,917	$0.17	$ 538,309	$5,749,966
1918	379,817	2,219,131	5.84	7,204,000	1,853,603	.26	768,386	4,841,120
1919	454,337	3,085,957	6.79	7,466,000	1,782,793	.24	1,161,898	6,030,648
1920	396,230	3,524,658	8.90	9,910,000	3,147,281	.32	2,054,503	8,726,442
1921	348,085	3,197,745	9.19	8,976,000	2,719,723	.30	1,404,538	7,322,006
Percentage of increase or decrease	—12.2	—9.3	+3.3	—9.5	—13.6	—6.3	—31.6	—16.1

*F.o.b. at point of shipment. †Chiefly slate granules.

This condition of stagnation is due to several causes. In the first place, the high percentage of waste, reaching from 75 to 90 per cent of total production, has added greatly to the cost of the finished product. Slate has also met with very keen competition from other products, and while it has high qualities that recommend it for many uses, there is scarcely a single application for which some other material may not be employed. For roofing, wood or asbestos shingles, tile, metal, and composition roofing are keen competitors; for blackboards, plasters and painted wood are substitutes; for switchboards, marble and soapstone, and for structural and sanitary purposes various kinds of stone, concrete or terrazzo are interchangeable with slate.

In addition to the handicap of heavy expense of waste and the competition of other products, the development of the slate industry has been retarded by high freight rates. Slate is a heavy product, and freight constitutes a large item in cost to the consumer. Most other roofing materials weigh less per square than slate and this gives them a decided market advantage. Slate has always borne a higher freight rate than many other building materials and while many of the latter have enjoyed commodity rates, slate has never been accorded a rate lower than sixth class. It has also suffered through lack of advertising while competitive materials have been advertised very widely.

Quarry Methods and Equipment

Practically all slate produced in 1922, except part of the Maine production, was from open-pit quarries. In some quarries the rock is freed from the solid ledge by blasting or wedging in drill holes. Blasting, except where very light charges are judiciously used, shatters the rock and results in great waste. Channeling machines are now used in Pennsylvania and Maine. The channeling machine is operated by steam or compressed air, and cuts a channel from 2½ to 3½ in. wide and from 6 to 12 ft. deep. Usually, wall cuts are made with it, and subsequent breaks by light powder charges or by wedging in a series of drill holes.

In early days drilling was done by hand, but steam or compressed air drills are now generally employed. Where roofing slates are made, the blocks are usually reduced by wedging to the desired sizes, though in a few localities they are cut across with a circular saw. All splitting is done by hand, and the final trimming is accomplished by a heavy blade set in motion by a foot treadle or by a rotary power-driven trimming blade. Finished slates are sorted according to size and quality.

Much of the Maine production is derived from mines, in some of which an overhead stoping method is employed. As the rock is worked down from the roof good blocks are removed and the waste is left on the floor, which is thus built up to keep pace with the upward progress of the roof.

Mill Equipment

Where blackboard, structural or electrical slate are manufactured, mills equipped with

modern machinery are necessary. The slate block is placed on a saw bed and cut across with a circular saw. The slabs may be spilt or reduced to proper thickness and uniformity by a planer similar to that employed in foundries. Bevels may be cut or edges trimmed with carborundum machines, and smooth surfaces are obtained by the use of sand and water on a rubbing bed—a large circular iron disc that rotates on a vertical axis. Final polish may be obtained by means of a buffer like that used in marble mills or by a belt sander.

Study of the Slate Industry

From 1920 to early in 1922 a detailed field study of the slate industry was conducted by the United States Bureau of Mines. Several short papers were issued at intervals as individual problems were completed, and a bulletin, No. 218, *"The Technology of Slate,"* covering all branches of the industry, appeared in December, 1922.

Recent Advances in Waste Utilization

During 1920 and 1921 the United States Bureau of Mines, in co-operation with slate producers and various manufacturing concerns, sought to develop new and wider uses for slate waste. It was found that pulverized slate is an excellent filler for various products, such as molded rubber, linoleum or paint, and particularly for road asphalt mixtures. A somewhat wider market has thus been developed for slate flour as a filler in a number of products. A small amount of waste is now manufactured into granules for slate-surfaced composition roofing, but the material for most granules is obtained from quarries worked exclusively for this purpose, and much of the material used is quite different from commercial slate. Aside from the regions where roofing or structural slate are produced, granules are manufactured at Esmont, Va., Fairmount, Ga., Jellico, Tenn., Lenhartsville, Albany and Charmian, Pa., Elsinore, Calif., Marquette, Mich., and Dresser Junction, Wis.

Waste slate may also be used to some extent for sidewalk stone, wall stone, fence posts, and for base courses in roads, but the difficulty of finding extended uses for it has led to the conclusion that the more important field for activity in the waste problem is to devise means of cutting down waste to the smallest possible proportions. This may be accomplished by avoidance of heavy blasting, substituting therefor the use of channeling machines or wedging; also by quarrying in accordance with rock structures such as joints or ribbons, and by manufacturing a greater variety of products.

Standardization of Structural Slate

The Structural Slate Co., of Pen Argyl, Pa., in co-operation with the Structural Service Bureau of Philadelphia, has made considerable progress in the standardization of structural slate, and has published a series of specifications. The object is to encourage the use of standard sizes and patterns, and to provide for architects' standard specifications that will greatly facilitate the ordering of slate installations. Such a movement will undoubtedly benefit the industry by increasing orders; by reducing the cost of manufacturing, and by permitting operators to manufacture standard sizes during slack seasons and to carry them in stock.

Standardization of Electrical Slate

Until recently definite knowledge as to the requisite qualities of electrical slate for switchboard use has been notably lacking. To supply the desired information, a series of tests of electrical slate were conducted in the Fritz Engineering Laboratory of Lehigh University. The results of these tests were used as a basis for formulating standard specifications for electrical slate.

Establishment of National Slate Association

The most notable event in the slate industry during 1922 was the establishment of a national association for advancing the welfare of the industry as a whole. Attempts to organize made in previous years met with little success. Owing to the chronic condition of stagnation in the industry it was felt that every effort should be made to establish a unity of purpose among the various producers as a means of combatting the influences opposing a larger growth. Through the broad vision of its president, W. H. Keenan, and the untiring activity of its efficient secretary, W. S. Hays, seconded by the active support of prominent producers, such as Messrs. Smith, Male, Norton, Chapman, Spinville, Morrow, Berlin, Lewis and others, the association, though only eight months in existence, has already made its influence felt. Forty-three companies, representing approximately 75 per cent of the productive capacity of the industry, are now identified with the association, and it is probable that other companies will join when they realize the practical benefits that result from co-operative effort.

A campaign for better freight rates was well under way before the organization of the industry was brought to a successful conclusion, the I. C. C. at that time ruling that freights on slate should be revised downward so as to bring them more nearly in accord with rates of competitive materials. A 20 per cent reduction—beyond a general 10 per cent granted July 1 on roofing slate—has been obtained, and a further reduction on all grades, together with a leveling of rate inequalities now out of balance all over the country, is in view.

A publicity campaign was opened by giving wide distribution to a four-page illustrated pamphlet outlining the qualities and uses of slate, and giving the names of members of the new association.

Other activities include cultivation of a market for pulverized waste slate and the development of a greater variety of products, particularly those that utilize small pieces. Other fields of active endeavor are the promotion of dependable salesmanship; proper standardization and representation of products; proper methods of placing slate on roofs or in other parts of structures, and uniform cost accounting.

Recent figures indicate that sales of slate for the first nine months of 1922 were higher than for a number of years, and the demand is growing. Although two of the largest quarries in the country were shut down for nearly five months on account of a strike, which is now fortunately ended, it seems probable that the current year will be one of the best in the last decade, and that the slate industry in its varied forms has entered upon a period of broader attainments and greater prosperity.

The New "Hendricks"

"HENDRICKS' Commercial Register of the United States" is part of the Hendricks Information Service, which latter also includes *Hendricks Commercial Bulletin* and the use of the Hendricks Information Bureau. The *Bulletin* is the monthly supplement to the Register, which keeps the latter uptodate in many of its details. The Information Bureau obtains special information for subscribers to the service and undertakes other services which are often of great value to subscribers. The new 1923 edition contains 150 pages over and above the 1922 edition; 125,000 changes and additions were made to the new edition.

The lists completely cover the electrical, engineering, machinery, building, manufacturing, chemical and other industries, together with all industries allied thereto. The lists are for the use of both buyers and sellers.

More than 18,000 products are separately classified with the name and address following of every manufacturer or producer, together with the trade name or brand, and also essential facts regarding the products of many leading firms. These classifications are made of easy reference by an admirable system of indexing.

All the manufacturers and others, besides being listed under all the products they handle, are also arranged in one alphabetical section according to name. All brands, trade names, etc., are arranged to name in one alphabetical list with the name and address of the manufacturer following.

This widely known annual publication has now reached its thirty-first annual issue. It is known as "The Original Register." During its 31 years of publication, purchasing agents, sales managers and others interested in the buying and selling of the products which the Register covers have found the work to be an invaluable adjunct to their business.

The Talc and Soapstone Industry

By Raymond B. Ladoo

The conditions in this industry during the past year were generally unfavorable and the price situation unsatisfactory, although reduced freight rates added some stimulus

THE talc production of the United States comes chiefly from two districts, one in north-central Vermont and the other in northern New York. The types of talc produced in these two districts differ so greatly that they do not compete with each other to a great extent. Thus the talc of St. Lawrence county, New York, is mostly fibrous, dense, rather hard, and of a very pure white color. It is used largely in the paint industry. Vermont talc is softer, has a foliated or granular structure, and is not as pure white as that from New York. The largest uses for Vermont talc are in the paper, rubber and prepared-roofing industries.

Other talc producing districts are in western North Carolina and northwestern Georgia; near Rowe, Mass.; near Easton, Pa.; and in Inyo and San Bernardino counties, California. The latter, of high grade and pure white, is used in the manufacture of toilet powder and for other purposes where a high-grade talc is needed.

Soapstone Production

Practically all of the soapstone, in massive form, produced in the United States during the past few years has come from near Esmont and Schuyler, Va. Pulverized soapstone has been produced at Henry and at Clifton, Va. During 1922 the National Soapstone Co., of Roanoke, Va., made some progress in developing a deposit of massive soapstone in Ashe county, North Carolina.

Year Shows But Few Developments

Owing to the greatly depressed condition of the talc industry in 1921 and its effect upon the market during the first part of 1922, there were very few important developments during the past year. Several of the smaller mines were closed down and a few companies went out of business. Most of the larger companies confined their new work to further development of their ore bodies. The principal new construction was done by the W. H. Loomis Talc Corp., near Gouverneur, N. Y. This company added new milling machinery which nearly doubled its capacity, built new storage bins for crude ore, electrified its mining equipment and installed electric lights in its mine. The method of continuous grinding and sizing by air separation has been so successful that the construction of a new steel mill was started. This mill is located about four miles from Gouverneur and was expected to be ready for operation about January 1, 1923.

Owing to the fact that there are several different types of talc and many uses for each type it is rather difficult to describe general market conditions for the whole industry. There are, therefore, individual exceptions to the following general statements regarding the trend of the industry during 1922.

Individual Improvements

The demand for talc was unusually low during the first few months of the year, but it gradually increased. In August there was a pronounced improvement, reaching a maximum in October. During the latter part of the year there was a slight decline, particularly for talc used in the prepared-roofing industry. Toward the end of the year the demand for California talc had nearly regained its strength shown in 1920.

No definite figures are yet available upon which to base an estimate of the total 1922 production, but talc producers have variously estimated that it will range from 65 to 85 per cent of the 1920 production. This will show a considerable increase over the 1921 production, which was the smallest since 1908.

Price Situation Unsatisfactory

The price situation throughout the year was very unsatisfactory, especially for Vermont talc, due in great measure to the large excess of talc producing capacity of the United States and the consequent destructive price-cutting to get business. At the start of the year prices were low and continued to decline for several months. As the demand increased prices grew steadier for several months, although with no price increases. In November—when everyone believed that prices were stabilized for 1923 contracts—price-cutting started again and the price of roofing grade talc (produced chiefly in Vermont but also by one or two mills in the South), dropped from $6.50 to $5 per ton. This is a new low record for recent years, and below the cost of production for most companies.

Prices on New York talc held up much better throughout the year and California talc prices remained at about the 1921 levels.

The tariff act of 1922 removed crude talc from the free list and imposed an import duty of ¼ cent per pound. The duty on ground talc was increased from 15 to 25 per cent *ad valorem*. On cut or sawed crayons, "lava" blanks, etc. (new tariff classification), a duty of 1 cent per pound was placed. The tariff on talc manufactures (except toilet preparations), wholly or partly finished, if undecorated, was placed at 35 per cent *ad valorem* (increased from 20 per cent), if decorated, 45 per cent *ad valorem* (increased from 25 per cent). The duty on talc toilet powders was increased from 60 to 75 per cent *ad valorem*.

Most domestic talc producers were chiefly interested in the ground talc item and it is reported that the talc producers feel that the 25 per cent *ad valorem* duty in the new bill is not satisfactory. A large part of the imported ground talc now comes from Canada and is so valued that the *ad valorem* duty which it pays is considerably less than the specific duty of $5 per ton on crude talc.

The Canadian talc production for the first six months of 1922 was 4890 tons, valued at $67,180. Canadian exports of talc for this period were 4969 tons, valued at $73,857.

Action of Rate Reduction

On July 1, 1922, freight rates were generally reduced about 10 per cent throughout the country. This stimulated business to some extent and helped the California producers meet Canadian competition in the Middle West. The Western producers, however, remained at a considerable disadvantage, although the high quality of some California talc has partially overcome this disadvantage in freight rate. During the first six months of 1922 the all-water freight rate on talc from Los Angeles to New York was $8 per ton. The present rate is $6 per ton and this is expected to continue at least until the middle of 1923. It is reported that California talc is steadily replacing imported talc in the toilet trade on the basis of quality.

The talc industry in general cannot prosper until the great over-producing capacity of the country is offset by the expansion of present uses or the discovery of new uses; by the cessation of production of some of the companies; or by increasing prices to a point which will allow a fair profit to the efficient producers. The time is certainly not opportune for the starting of new talc-mining ventures.

Sand-Lime Brick Industry for 1922

By W. H. Crume
President, The Crume Brick Co., Dayton, Ohio

Many plants in this industry have turned out record productions during the year. Several new plants have been constructed throughout the country and the increased capacity of many old operations has been common. Mr. Crume predicts a steady growth of business for the next two years

IN THE main, the year 1922 has been very satisfactory for the sand-lime brick industry in general. While business has been somewhat spotted, it will average much better than for 1921. Several of the sand-lime brick plants have turned out a record production for the year although some of them, due to strikes in the building trades and bad local business conditions, have not had a successful season. There have been several new plants put in commission during the year. Among them are the Paragon Brick Co., of Elizabeth, N. J., which sells the bulk of its brick in New York City, and the Clayton Brick and Tile Co., of Dubuque, Iowa. Other plants are being projected and will probably materialize during the coming year.

A still more healthy condition in the business is shown in the increasing of capacities of a number of the older plants, and an almost universal improvement in equipment, both with the object of increasing the output and decreasing the proportion of common labor required. The latter, of course, means the installation of improved labor-saving devices.

Prices for the year, with the exception of those in one or two localities, have been held up to a standard that should result in a fair return on the invested capital.

It is the writer's personal opinion, and has been for the past several years, that the common labor situation will steadily grow worse, and only the fact that there has been a great increase in the use of labor-saving devices has prevented a crisis. With general business improving throughout the country, as it seems to be at the present time, I believe that by the summer of 1923 the common labor situation will become most acute, and I look for the price of common labor, employed on hard, steady work, to increase to a point higher than the so-called skilled trade, and to remain there until a change in the immigration laws are made.

Under present conditions of the labor market it will be next to impossible, in my opinion, to obtain men who will work at many of the tasks which require the constant grind of hard, rough work. Therefore, it is up to the equipment companies, or the factories who have to do these tasks, to devise mechanical means for doing them. As a matter of fact, there is no excuse for an employer to compel men to work as beasts of burden when mechanical means can be devised to do the tasks. Even horses are not required to do the hard pulling and carrying formerly done by them in the cities. It has been found better and cheaper to do the tasks with motor trucks, steam shovels, ditching machines, etc.

As a whole, the sand-lime brick factories use far less common labor per thousand brick than is used in the clay-brick industry, and with the present tendency to eliminate every hard job about the factory, the proportion of men used is growing less.

The outlook for the sand-lime brick business is very promising and I believe there will be a steady, conservative growth for the next two years.

Twenty years have passed since the first sand-lime brick factory began operating in the United States, and notwithstanding the prophecies of our principal competitors—the clay brick manufacturers—the industry is in better condition today than ever, and the use of sand-lime brick is bound to increase.

Through the efforts of the Sand-Lime Brick Association the quality of sand-lime brick has been improved and will continue to improve.

Birdsboro Co. to Rebuild

MANY extensive changes are being made and several new pieces of equipment are being installed at the plant of the Birdsboro Stone Co., Birdsboro, Pa.

The company's engineers have drawn up plans for the remodeling and consideration was given to the laying of foundations and wrecking the old buildings while the plant is still operating. At the present time, practically all foundations have been placed and much of the old construction has been torn out, so that when the present season ends the new equipment can be installed and the new buildings erected in a comparatively short time.

All of the crushing and screening buildings, which are of wooden construction, are to be replaced with reinforced concrete and structural steel buildings. A new 54-in. conveyor will replace a 60-in. elevator now used between the primary crusher and the secondary units. The 60-in. elevator will be installed to move the material from the secondary crushers to the screens, this elevator replacing a 42-in. elevator formerly in use.

The company is having constructed a 30-in. Superior crusher which will be installed as a secondary unit. This crusher is of a special design and will have as one of its features a suspension nut of the company's own invention. This crusher will replace a No. 10 crusher of the same make.

The company's modern machine shop and electrical welding equipment make it possible for the company to rebuild its 60x84-in. Power and Mining Co. jaw crusher, which was broken and temporarily repaired during the past season. One of the side frames of this crusher was broken and the company repaired it by bolting it together. This was done by using 12-in. x 12-in. x 10-ft. steel billets and 8-in. x 25-ft. forged bolts. This method of repairing has proven satisfactory, but was intended only as a temporary repair.

Although the present plant has a rated capacity of 5000 tons of crushed stone per day, its average capacity has been but 3500 tons. It is estimated that the plant, after remodeling, will be able to maintain an average of 5000 tons, and that by being forced can produce 7000 tons per day.

The reconstruction work is under the direction of William Kelly, plant superintendent, and is expected to be completed about March 1.

Evolution of the Power Shovel

By Harvey T. Gracely
The Marion Steam Shovel Co.

The steam shovel still maintains its place in power-shovel construction, but gasoline and electrically powered machines are now being perfected to the same degree of efficiency as the steam shovel

IT has been decidedly interesting to observe the mechanical development of excavating and loading equipment, especially as applied to the rock products industry. To anyone who has kept apace with the engineering progress of the various types of digging and loading machines, the experience has been both interesting and instructive. Years ago even in the largest operations, the practice of hand loading, with team and scraper stripping, seemed almost universal. Mechanical devices for handling blasted rock and for loading coarse and heavy materials were not considered practical. This was because they had not yet been perfected to a degree that would permit them to withstand the heavy duty in quarry service. The idea seemed to be common that there was not much need of efficient and economical equipment. Also, there seemed to be no desire to study even the most common labor saving devices. Labor was one of the cheapest commodities and there was plenty of it for all requirements.

But now, when the demand for manpower has increased with such determined insistence, every available agency for multiplying it must be employed. In the accomplishment of this, the power shovel has come to be recognized as a most important factor. And quite properly too, for the smallest shovel can easily replace 40 or 50 men and the largest can accomplish more than a crew of several hundred men.

Power Shovel Stabilizes Production

The power shovel is one of the most reliable means of stabilizing production, regardless of working seasons and plant conditions. This is especially true with firms that have provided for all-year operation by storing in winter and during the dull seasons, and loading out several times the normal capacity of the plant during the time of heaviest demand.

With the introduction of the first power shovel in a rock quarry many of the inconveniences of hand labor were eliminated and the industry as a whole took on an entirely different attitude respective of management and operation. Production was immediately speeded to a degree never before known, and economies were effected that were actually astounding.

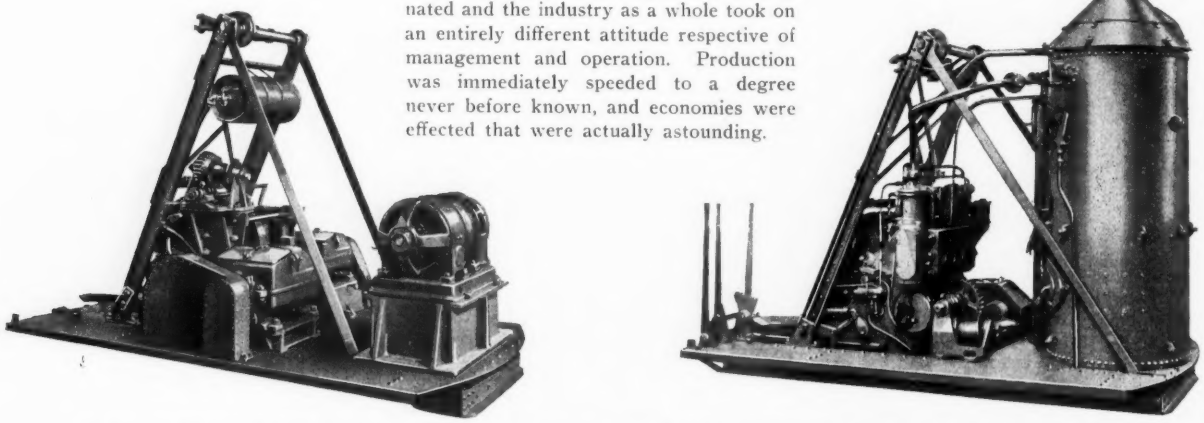
At that time very little was known about internal combustion engines. Their adaptability had not been determined and their use was confined largely to minor installations. What few engines there were seemed to be in no way adapted to the rigorous demands of equipment in the excavating field. The cost of electricity for power purposes was almost prohibitive in those days and as a consequence no thought was given to machines of that type.

The First Steam-Driven Shovel

Under these circumstances it was quite natural that the earlier machines should be steam driven. Boilers and engines, though not developed to any high degree of efficiency and economy, were easily understood and readily operated. They were accepted universally as a power unit for practically all types of equipment in outdoor service.

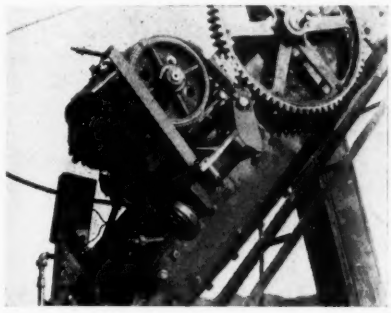
As time progressed, the gradual tendency seemed always to be toward larger and heavier machines until now the size most commonly used is the 100-ton shovel, equipped with a 4 or 5-yd. capacity dipper. With materials weighing 100 lb. per cu. ft. this type of shovel lifts from 5 to 7 tons at each dip. With such equipment available it is no wonder that progressive firms have departed entirely from hand loading methods, and it is not surprising that the user should have an ever constant desire for the most efficient and modern machine his money can buy.

Realizing this fact, manufacturers have wonderfully developed their standard types in keeping with all the demands of the industry. Not the least important of these has been the gradual change from



Note the similarity of construction between the steam outfit and the three-motor electric. The bearings, drums, and frames on both outfits are alike

steam-driven machinery to gasoline and electrically-operated units. There are many reasons for this change. First of all, the handling of fuel for a steam machine is always an expensive and arduous task about any open-pit operation. Coal must be removed from cars and from storage regardless of the condition of the pit or location of the machine. It must be loaded on the shovel at a time when it does not interfere with the plant operation. This means extra work between shifts with its consequent inconvenience. The problem of good feed water is a very important one. The solution of this problem brings with it considerable expense in water softening devices, filters and purifiers and boiler cleansing materials. To partly overcome these conditions, water is



On the all-electric machines the line current is carried from the lower to the upper frame through the center journal. Three slip rings are provided with brushes, cables and connections

sometimes brought from considerable distances to eliminate the dangers caused by the heavy alkaline-content in water obtained on, or adjacent to, quarry properties. Freeze-ups in winter are a continual source of inconvenience and expense, and unless pipes and engines are properly drained there is an ever present danger of serious delays.

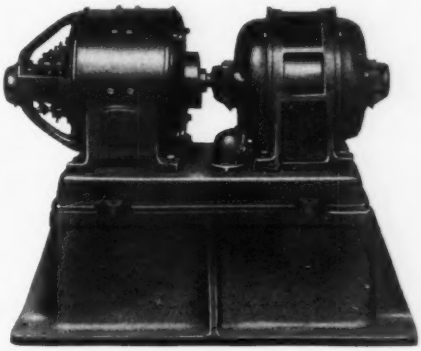
In spite of these difficulties, and others of minor importance, steam has unquestionably maintained its leadership in power shovel construction. This leadership has been maintained, possibly, because of its almost universal use, and its ease of understanding and vast and potent possibilities. But now it lays no further claim to continued dominance in the rock products industry, for the trend of the times is toward electrification and toward a more general use of gasoline and oil engines.

Tendency Towards Electrification

It is only natural that stone, lime and cement plants, gravel pits and other kindred industries should be actively engaged in plant electrification. Cheap hydro-electric power is now available in many localities and a number of new projects are at this time under construction. High voltage transmission lines carry this power great distances with but little loss and at remarkably low cost. Where such power is not available, central power stations can be erected with efficient methods for handling fuel and water. With central power stations electric current can be generated at low initial cost for distribution to every part of the quarry or pit.

In recent years manufacturers have spared no effort in developing shovels that could be operated entirely with electricity or with internal combustion engines. It seemed to them that machines of either type would have a very general and extensive application in quarry service and in sand, gravel or clay pits. As a result many different types are now on the market, most all of them being beyond the experimental stage and meeting with more or less general acceptance.

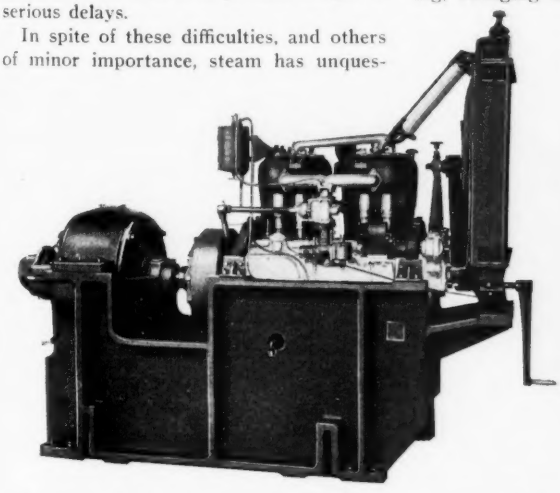
Comparing the several designs one might classify them in two distinct types —"single motor equipment" and "independent three-motor drive." Any power shovel, irrespective of make or type, has three major operating movements—hoisting, swinging and crowding. The hoisting movement has reference to the lifting control of the dipper which is usually accomplished by winding a chain or cable on the hoisting drum, this being a part of the main machinery on the shovel body. The push or thrust to the dipper is transmitted through the dipper handle, the upper end of which is carried on the shipper shaft and to which the crowding engine is geared. On revolving shovels the swing-

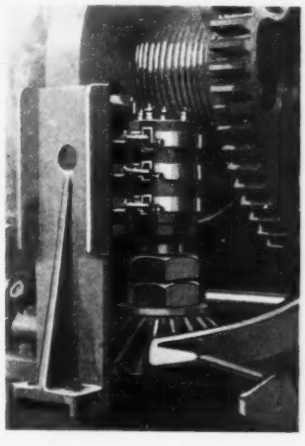


An all-electric shovel generator set. It comprises an induction motor direct-connected to a direct-current generator

ing of the boom is accomplished by rotating the entire upper frame of the shovel; whereas, on railway-type shovels the car body is stationary, and the boom, dipper handle and dipper swing through an arc of approximately 180 degrees.

The propelling mechanism is usually arranged as a part of the hoisting machinery and when this is done it is driven from the main hoisting engines. On the earlier steam machines all the hoisting, swinging and crowding operations were handled from a single set of engines, through frictions and brakes properly proportioned and arranged. It is this construction that approaches the present single motor electric and gasoline machines.





Gasoline engine and generator used on a gasoline-electric type. The fuel tank is located within the base casting. The controllers on the all-electric shovels are at the front end of the shovel where the operator can see the dipper at all times. The dipper handle is always under complete control due to a locking arrangement

In this type, all the machinery is driven from one prime mover, and this, of course, must be powerful enough to take care of the peak loads of hoisting and crowding, and also be able to hold the dipper in extreme dumping position while swinging. There are some advantages in this type, principally in the fact that the power unit is contained in one piece of equipment which, it is claimed, adds to the simplicity of the machine and reduces the number of units necessary for the handling of the several operations.

Independent Three-Motor Drive

With the introduction of the three-motor drive, shovel construction advances into a new era. In this type each operating unit is independent, and all the performance characteristics of the late type steam machines are maintained. This means that the hoisting, swinging, and crowding operations function through separate motors, and the general principle of control and operation is identical with the steam machine. This is a radical departure from anything heretofore considered for power shovels and it is the basic idea upon which the new type is founded. By following this idea of construction many parts ordinarily used on the standard steam machines are retained on the electric and gasoline-electric outfits.

On the all-electric machines the power plants vary in horse-power for the different capacities of the shovels, although the general layout is the same in all cases. The primary current is brought to the shovel by means of a specially wound and insulated cable. This method of bringing current to the shovel is in striking contrast to the more arduous method required in coaling a steam machine.

Small Electric Revolving Shovels

On small revolving shovels the line current is carried from the lower to the upper frame through the center journal. Three slip rings are provided with brushes, cables and connections substantially mounted and properly insulated against contact with the machinery.

A direct-connected motor generator set is installed at the rear of the upper frame, located at approximately the same place as the boiler on a steam machine. With alternating current, this set consists of an induction motor direct-connected to a direct current generator of special design, having a drooping voltage characteristic. Although standard equipment is usually for 3 phase, 60 cycle, 440 volts alternating current, the motor generator set can be furnished for 220 or 550 volts; 25, 40 or 50 cycles, and 2-phase alternating current if so desired. When the power supply is direct current the shovel can be operated under certain conditions without the motor generator set. This arrangement however, is not recommended, for the many advantages of the variable voltage, supplied by the special wound generator, are lost and the output of the machine is considerably reduced. For best results the motor generator set should be used.

The motors on both electric and gasoline-electric outfits are mill type, series wound, 230 volt, direct current, and are geared to their respective units in practically the same manner as the engines on the steam machines. In the accompanying illustration the larger motor on the left is the hoisting motor, geared to the main drum through an intermediate shaft. The other is the rotating motor, connected to the vertical rotating shaft through a series of gears, all of which are located above the floor, where they are readily accessible for lubrication and attention.

One of the largest railway-type steam shovels in action

On the gasoline-electric outfits the power unit is composed of an engine and generator consisting of a heavy duty gasoline engine of vertical type, fitted with governor, carburetor, magneto, oil pump, water circulating pump, radiator and fan. The gasoline supply tank is located under the engine, inside the base casting. Electric current is generated in the special wound direct current generator, which has the same characteristics as the one on the all-electric machine. From this generator feed lines lead to the controllers at the front of the shovel. Three controllers—one each for the hoisting, rotating and crowding—are located at the front of the upper frame. From these, lines lead to their respective motors. The control levers have movements identical with the steam machines, and any operator familiar with the handling of a steam shovel can understand and operate this new type. At the front of the upper frame, on the side opposite the controllers, is the direct connected motor driven air compressor. It supplies air for the hoisting ram and the self-locking crowding brake and is automatic in operation.

The control equipment in all cases consists of reversible drum controllers with vertical handles and suitable resistors. The latter are of a new and improved type, especially designed to withstand the severe vibration encountered in this class of service. In addition, the hoisting and crowding circuits are protected by a contactor and a relay which cuts a large block of resistance into the circuit in case a stalling load is encountered. This arrangement is of special importance to the quarry operator.

The protective relay panel is a special feature of the control equipment. In connection with the drooping voltage it is designed to protect both the motor and the generator from damage when a heavy rock or other obstruction that overloads the motor is met. Instead of merely breaking the circuit, as is the case with most overload protective devices, it inserts enough resistance in the circuit to limit the current to a safe stalling value. To automatically reset it and cut the resistance out of the circuit, the controller is turned back to the second point.

The three operating handles for the drum controllers are located at the front end of the shovel, close to the boom, so that the operator has an unobstructed view of the dipper. Each controller has five operating points in each direction, and is designed to work with the minimum amount of effort on the part of the operator. The starting, plugging and protective resistors have been designed for minimum space requirements, but with ample capacity for the most severe working conditions. They are mounted beneath and inside the shovel at the most convenient point compatible with a simple and accessible wiring scheme.

Complete control of the dipper handle is obtained by the introduction of a unique locking arrangement. The primary purpose of this crowding lock brake is to hold the dipper and dipper handle in a

fixed position when the power on the crowding motor is released. The entire mechanism is automatic, being affected as to movement by the position of the control lever at the operator's stand. When the controller is moved, either in the forward or reverse direction, it automatically cuts in a magnet valve located on the boom which regulates the admission of compressed air into a cylinder and sets or releases the band as the case may be. This device effects a great saving in power, for it is not necessary to hold current in the motor when holding the handle in any desired position.

Electric Railway-Type Shovels

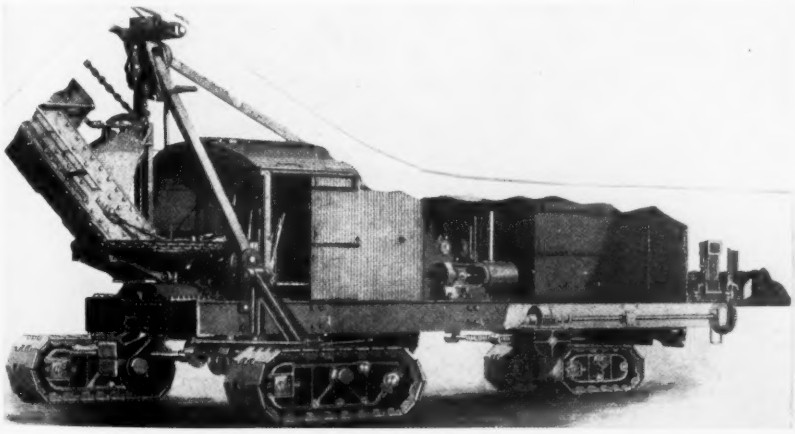
By far the major portion of railway-type shovels now in use in the rock products industry are steam driven, though there is an ever-increasing demand for electric outfits. On these shovels the car body is stationary in relation to the boom and dipper, thus affording an excellent frame structure on which the machinery units are mounted. Gasoline or oil engines have never proven satisfactory on shovels of this kind, largely because the various movements of the shovel parts are not readily adapted to single engine drive.

Because of the heavy duty imposed on shovels of this type, and because of the high torque required at the slow speeds, direct current has many advantages over alternating, especially where it is desired to approximate the efficiency and economy of the steam machine. This, of course, does not prevent the use of alternating line current but merely applies to the current used in the shovel motors. When the primary current is alternating, a motor generator set is used and this is located at the rear of the shovel frame in approximately the same position as the boiler on the steam machine. If direct current is supplied to the shovel it is not absolutely necessary to use the motor generator set, but for an economical and efficient operation it is to be recommended.

The motors are direct geared to their respective units and the control apparatus functions in practically the same manner as on the revolving type.

Large Revolving Shovels

Where deep quarry faces are being worked or where exceptionally heavy materials are being handled in great quantities, there are many distinct advantages in the large revolving type. These shovels are equipped with 6 to 8-cu. yd. capacity dippers and can be fitted with 80 to 90-ft. booms. In working condition they weigh from 200 to 350 tons. Although their first use was in coal stripping they are now being profitably employed in all kinds of open pit operations. Due to their large size and wide working range, they can handle a much deeper quarry face than any of the railway types. The radius of clean-up is so much greater that it is seldom necessary to move up oftener than once on each shift. This, of course, depends entirely on the formation and the manner in which the property is worked. As a general rule, a railway-type shovel will necessitate from 5 to 8 times as many move-ups as a large revolving machine. Both steam or electric outfits are available, and the same advantages apply as described above for the smaller machines. Some of the latest machines of this type are fitted with superheaters and the boilers are provided with automatic stokers.



A railway-type shovel mounted on caterpillar trucks. Because of the three-point support all twisting of the shovel body is eliminated

Application of Caterpillar Mountings

Caterpillar trucks are now almost universally applied to shovels under 150 tons working weight regardless of the power used. Above that size, the machines are so large and heavy, and their working range so great, that the practicability of crawler trucks has never been definitely established. The most general use of caterpillar trucks is on shovels of 25, 40 and 60 tons weight, carrying dippers of ¾, 1¼, 1¾ or 2 cu. yd. capacity. Most shovels of this size are of the full revolving type, and because of many operating advantages, their use has become more and more extensive in the various forms of quarry and pit operations.

On revolving shovels there are several types of caterpillar trucks. These are generally classified as flexible, semi-flexible and rigid, each having distinct advantages when operating under certain conditions. The usual construction is to have one crawler belt at each side of the shovel extending approximately the length of the under-frame and with sufficient bearing surface on the ground to properly support the machine, especially when working on soft bottom. If the grade is uniformly level and smooth, either type of truck will operate satisfactorily, but if the working surface is rough and uneven, it will be well to consider some form of flexible or semi-flexible truck, to avoid the tipping of the shovel body when working or moving over obstructions. The accompanying illustrations show the characteristics of each type, and their separate advantages can be quite readily visualized.

On railway-type shovels there is usually one crawler truck located at each side of the machine. These trucks are located at about the same place where the jack blocks are located when the shovel is mounted on railway trucks. The caterpillars, in addition to forming the trucks on which the shovel moves, also take the place of the jacks and jack blocks, saving considerable time and labor in moving up. At the rear of the machine there is only one truck unit, and this is set under the center of the shovel in such a way that it can swivel in several directions. This truck is connected, through a series of shafting and gears, with a steering engine thus making it possible to turn the shovel in a short radius. This is a very important feature when working in limited space or when moving the shovel back and forth along the quarry face.

It is not possible to operate a railroad-type shovel on ground as soft as a revolving-type will operate on. When digging, almost the entire pull of the dipper, plus the dead weight of the forward part of the machine, is transmitted to the trucks, thus increasing the pressure on the ground way beyond that obtained on the revolving type. No difficulty is encountered when the shovel is working on the quarry floor. But when stripping, the shovel should be kept at all times at the bottom of the dirt overburden.

The distinct advantage of crawler trucks on railway type shovels is the elimination of several pit men. Thus the handling of ties, rails and supplies, jacks and jack blocks is also eliminated. This feature makes for increased working time, thus decreasing the unit cost of material handled and which is, of course, reflected in lower cost of the plant operation.

It is extremely doubtful that there will be as many improvements in the next decade as have occurred in the last. All types of shovels—steam, gasoline and electric—have to a certain degree become standardized. Their performance under all conditions has been determined to a rather high degree of accuracy. Changes will be made continually quite true, but it is generally predicted that there will be no radical departure from the typical designs now in general use.

The Slag Industry

By H. N. Snyder
Manager, Buffalo Slag Co., Buffalo, N. Y.

A summary of the slag industry for the past year shows that its development along equipment lines has progressed in parallel lines to that of the stone-crushing industry

A REVIEW of the slag industry for the past year should be written by some one having available information from all of the producers. Without such information, the writer can only judge the industry from knowledge of a comparatively small part of it.

There are various kinds of slag and it has a number of special uses, but in this article "slag industry" refers only to the preparation and sale of blast-furnace slag. This industry has a history of about 20 years and started like similar ones with the pick-and-shovel as the means of excavation; small horse-drawn cars as the means of transportation; and a small jaw crusher, one screen unit, and open-air bins as the plant layout. The equipment development progressed along with the stone-crushing industry and as the problems are similar, the modern layout comprises steam shovels for excavation; locomotives for transportation power; side-dump or hopper cars for transportation; and a plant containing gyratory or roll crushers, several screen units, and concrete or steel bins, all properly housed. As 1922 is the year of interest in this statement, progress in plant facilities has been made during that period mainly along two lines—buildings and screens.

Tendency to Build with Steel and Concrete

It has been customary in the matter of buildings, with some exception of course, to use timber construction. Of late, however, the tendency is to build with steel and concrete. There have been several of such plants so constructed during the past year. In plants of timber construction there has been a great deal of damage caused through vibration, and this is especially true in plants using shaker screens. These have had a considerable use in this industry. Therefore, it is only natural that greater strength should be built into the structures.

In the matter of screens, the sizing or screening of slag has perhaps received more attention than any other one operating problem during the year. Any rock product used for railroad ballast, highway construction, or concrete aggregate must be properly sized to give the best results. Perhaps the most troublesome thing a producer encounters with his trade is the rejection of a carload of material and I venture to say that 90 per cent of such rejections are based on improper sizing—usually caused by the existence of fines in the coarser grades. Rejection of material at the job is very costly to the producer of the material and he is fortunate if he succeeds in having the material unloaded for the freight charges only.

Slag's Screening Problems

The screening of slag or stone in large volume has presented a problem for a good many years. The slag industry has utilized nearly all types of screens, including the following:

Revolving or rotary.
Eccentric driven shaker.
Crank shaft driven shaker.
Knocker or three-cornered cam.
Grizzly bar.
Electrically vibrated.

The general opinion seems to be that a revolving screen is not a screen of large capacity and from which many sizes are required, but that it is the best type primary separator of sizes leaving cleaning-up work to other units. Of all the screens tried, however, it is the most economical screen for producing large tonnages.

Shaker screens, as stated, have been used to quite an extent for separating into sizes material from 1½ in. down. They have given excellent results so far as quality of product obtained is concerned but they have been very expensive to operate, in that repairs and new screen expense are heavy. Also, in a plant of ordinary timber construction, the damage from vibration caused by the screen is very noticeable.

Knocker screens, which are usually homemade, consist of an inclined screen on a frame, agitated by the rotation of a shaft on which are mounted three-cornered cams. This type has been used to a large extent. They can be installed easily in small space, and have been of considerable help in cleaning up a special size, or for removing a part of the fines from the product as it comes from the crusher, prior to its entrance to the main screen unit. The chief objection to this type of screen is the jar caused by its operation and the attending results.

Grizzly screens are used quite extensively to separate slag coming from steam shovel equipment quarries. This operation usually takes place before the material is fed to the crusher.

The electrically vibrated screen is not a product of the year 1922, but in this industry it has probably gained more friends and advanced the proper sizing of material more than anything else during the year. Judging from a period of two years' use of the vibrating screens for both primary separation and as finishing screens, the writer believes they are one of the best screens yet developed. Some types are built so that they can easily be moved from one location to another in order to take care of some special screening work. They have been found thus far to be very economical in operation expense and give good results. The writer knows of three types of this screen now in use in the slag industry, all of which are rendering good service.

Market Conditions

Market conditions during 1922 were what might be termed fair. There was a great amount of construction undertaken, but in some localities it was late in starting. Then when everything seemed to be well under way, transportation troubles began. The effect on the slag industry was, of course, serious. It has had the result of giving further impetus to transportation by truck and certain business that the railroads have enjoyed heretofore is permanently lost to them. One producer of slag moved 78,000 tons by this method during the year. It is estimated that the output of the slag industry in 1922 will total about 6,000,000 tons.

1922 in the Crushed-Stone Industry

By Brownell McGrew
Engineer, Allis-Chalmers Mfg. Co.

IN LOOKING back over the activity of the past year in the quarry industry, one is struck by the fact that 1922 has been distinctly an off year in so far as new quarry development and new crushing plant construction are concerned.

At first thought this seems rather surprising in view of the brisk market for crushed stone with which most territories were favored, and also in that the usual number of promotional enterprises were being energetically pushed by the men behind them.

Why Development Has Been Slow

Capital seems to have taken a very cautious attitude toward new quarry development, an attitude which, on the face of things, does not appear compatible with the present healthy condition of the crushed stone industry.

In seeking the reason or reasons underlying this attitude, one is impelled toward the conclusion that the trouble is not attributable to the industry itself, but rather to the general transportation situation and to the extremely uncertain building trades conditions that have prevailed throughout the country for the past several years.

The former factor has been a thorn in the side of the industry ever since the World War, but it is a condition that now seems to be in a fair way toward being ironed out, though the process is necessarily a slow and laborious one. The labor unrest, which had practically throttled building activity in the industrial centers of the country, has adjusted itself to a large extent, with the result that 1922—which at first promised to emulate its predecessor as a "buildless" year—has been a banner season in practically all of our cities.

Next Year to be Brighter

All in all, the slump in new quarry development and crushing plant construction, which characterized 1922, appears to be nearing its end and the prospects for 1923 are much brighter.

A very conclusive indication of the healthy status of the industry itself is the activity which has manifested itself on the inside—that is, in the revamping and enlargement of old crushing plants, much of this work being done with surplus earnings and without borrowing.

By far the greater proportion of this activity has been directed toward two particular phases of plant remodeling: 1. The installation of larger initial crushers; 2. The improvement of screening facilities.

Why Larger Crushers are Being Installed

Two factors have been largely responsible for the marked leaning of quarry operators toward larger primary breakers: the desire to realize the advantages of the large receiving opening in reducing quarrying costs and the necessity for increased capacity. In the majority of instances, the latter has been the predominating factor. It is easier to figure the increased profits on an augmented output than it is to estimate the number of cents per ton that one may expect to save in drilling and shooting. None the less, quite a number of big machines have been installed recently for the sole purpose of cutting costs, no increase in output being desired. There has been a decided trend in this direction in the cement industry, where the problem of cost cutting seems to be receiving very close attention in all departments.

In the majority of cases that have come to the writer's attention, the new initial crushers have been installed ahead of the old primary machines, utilizing the latter as secondary crushers; this is sound engineering when the increase in size is relatively high. The new machines installed cover a wide range of sizes and types, with the gyratory leading as usual by a comfortable margin over its rival types. In most cases the increase in size has been conservative and expenditures have been well within what the operation is capable of carrying, on its earnings. The quarry operator, especially the small one, seems inclined to look upon his business as a season-to-season enterprise and to feel that the busines should pay off improvements on that basis.

Why Vibrating Screens are Popular

To meet the demand for cleaner stone, especially in the smaller grades, many operators have found it necessary to revamp their screening plants. In general, this has been effected by the addition of shaking or vibrating screens to take care of the separation of these small sizes, relieving the revolving screens of this portion of the work and enabling them to handle increased tonnages of the coarse grades and to deliver a cleaner product.

The shaking screen—tried out many years ago and discarded to a large extent on account of mechanical trouble—has come back into the field in improved forms, with most of the kinks taken out. It is now winning well-deserved popularity among quarry operators who have tried it out. In its present stage of development its efficient scope is limited to the separation of sizes between 1½ or 1¼-in. and four mesh. It does this work very well, provided the material is not too wet and sticky.

The shaking screen has a sturdy rival in the several forms of vibrating screens now on the market. A number of operators have tried this latter type of separator with good success. In their present stage of development their field of effectiveness laps over the smaller sizes for which the shaking screen is adapted and extends on down into the fine meshes used for segregating agricultural limestone, etc. In their application to the commercial crushing plant they seem to be subject to the same limitation, although perhaps in a lesser degree, that applies to the shaking screen, namely, the tendency to plug up when handling wet, sticky material. It may be remarked here that nothing has been developed during the past year to solve that blood relation of perpetual motion, the dry cleaning of dirty stone.

Demand for Small Stone Increased

The great building boom of 1922 created an unprecedented demand for small stone, principally 1¼, 1, ⅞ and ¾ in., and that this demand will continue seems likely. Many operators found themselves unable to fill their orders for these sizes while at the same time the coarse grades were begging for a market, particularly in sections where the railroads did but little ballasting. Consequently recrushing equipment came in for some attention, although additions to this part of the plant equipment have not, generally speaking, been as liberal as the demand for small stone would seem to warrant. Indications are, however, that the present winter will see shortages in this department corrected in a number of plants.

Few Quarry Improvements

Turning from the crushing plant to the quarry, one finds no outstanding monument of invention or improvement to mark the past year. Nevertheless, a steady improvement in general quarry practice and a general physical betterment of quarry properties are evident to the trained observer. Heavy, standard-gage

equipment is gradually replacing the old-style, low side, narrow-gage quarry car—hang-overs from the old hand-loading days—in those quarries where shovel loading has been adopted. Light rail and bridle bar have long since given way to 60-lb. steel and cross ties in the modern quarry; and we now have with us the progressive operator who uses quantities of his own product to ballast his quarry tracks, maintaining them, as nearly as practicable, in "main-line" condition. And this practice, by the way, will pay as high a dividend on the money and time expended as any other one refinement in the quarry game.

Progress in Electrification

Electrification in crushing plant and quarry goes steadily forward wherever power is available at reasonable rates. Motor driven pumps, chiefly of the centrifugal type, have to a considerable degree replaced the steam-driven piston and plunger pumps for drainage and water supply service and the motor-driven well drill is firmly established.

Electricity in Quarry Not Fully Developed

Electric quarry transportation has not as yet reached a stage of development that need cause the manufacturers of steam locomotives any immediate worry. The cost of installation; transmission maintenance and expert attention required are the restricting factors so far as the small operator is concerned. On the other hand, this system of haulage, and notably the Woodford system, has made a truly remarkable record of economy and reliability in practically every large capacity quarry where it has been installed, and that its field will spread from year to year is assured.

Substantially the same remarks apply to the electric shovel. The electric shovel, in common with all new mechanical ideas, had numerous kinks which had to be unraveled to put it on a sound commercial basis, and the quarryman has in the past been chary of adopting this type of loader, preferring to see it "tried out on the dog" first. Now that the electric machine has been raised to the same plane of reliability as its steam prototype it will undoubtedly assume a more commanding position in the industry in the near future.

Plants Improved in 1922

The state of Ohio easily takes first position for the year 1922 for activity in new plant construction and plant remodeling. At the Marblehead quarry of the Kelley Island Lime and Transport Co. stands a newly completed crushing plant that is an imposing monument to modern crushing-plant engineering and to the enterprise and progressiveness of the owners. This plant, having two 48-in. gyratories for initial breakers, and designed for a capacity of 10,000 tons in 8 hr., takes first place in the world's register of combination flux and commercial mills.

The following list, while making no pretensions to completeness, gives an idea of the character of new installations and enlargements, either completed or inaugurated during the past year in various parts of the country.

Kelley Island Lime and Transport Co. New crushing plant at Marblehead, Ohio. having two No. 24 and two No. 8 gyratory crushers.

Brokensword Stone Company. Addition of a No. 9 gyratory to its old No. 6 plant at Bucyrus, Ohio.

Wood County Stone and Construction Co. Addition of a No. 9 gyratory to its old No. 7½ plant at Bowling Green, Ohio.

Daniel Evans Stone Co. Addition of a 27-in. crusher to old plant at Marion, Ohio.

F. W. Katterjohn Construction Co. Addition of a No. 12 crusher to its old No. 7½ plant at Cedar Bluff, Ky.

Lutz Stone Co. New No. 12 crushing plant at Oshkosh, Wis.

Duluth Crushed Stone Co. New crushing plant with two No. 12 crushers at Duluth, Minn.

Monon Crushed Stone Co. Addition of No. 18 crusher to its old No. 8 plant at Monon, Ind.

Columbia Quarry Co. No. 18 replacing old No. 12 crusher at Columbia, Ill., No. 1 plant; No. 8 replacing old No. 6 crusher at Columbia, Ill., No. 2 plant.

J. D. Owens & Sons Co. Remodeled No. 7½ plant at Owens, Ohio.

Conclusions

Summing up the achievements of 1922 in the quarry industry, one cannot but feel a sense of satisfaction and encouragement over what was accomplished, and high hopes for the future. While it is extremely doubtful that the industry will ever again pass through such a period of amazing growth as characterized it during the first 15 years of the present century, there can be no doubt that it is destined to experience a steady and healthy development that will parallel the general industrial development of the country. The good-roads movement will certainly continue and the continuance of the building boom is almost equally certain. Also, it is clear to the most casual observer that the railroads must do more ballasting in the near future if they are to continue to do business.

The quarry operator may well look forward to the year 1923 with an optimistic heart.

Shifting Storage Piles

HOW Japanese engineers have applied the combination of a box-car loader and a portable belt conveyor for storing and reclaiming their coal, is shown in the accompanying illustration.

By combining the use of the two machines these Japanese workmen find moving a storage pile an easy task

When it is necessary to move an entire pile from one place to another and it is desired to pile high the material, the combination of the two machines answers the purpose. The conveyor provides the way of moving the material from one pile to another, while the car loader gives it an additional elevation. Because of the latter's high speed, the material is thrown a greater distance and height.

The example set by the Japanese can be followed by sand and gravel and crushed stone operators in this country by applying the use of similar machines in their own storage yards in handling sand and gravel screenings and other materials.

Transportation and Its Problems

Service and freight rates are the elements in transportation problems that are of most vital interest to producers in the industry

By Edwin Brooker
Commerce Specialist and Statistician, Washington, D. C.

TO most shippers transportation is an essential part of their own business. With it they place their products on the market, but without it they are handicapped, and any curtailment thereof must result in consequent losses on account of higher operating expenses, accompanied by reduced production. There is no class of shippers by railroad who have suffered more through the deficiencies of railroad operation than producers of sand, gravel and crushed stone.

Two Vital Elements

There are two elements in the transportation problem which are of vital interest to the producers of these materials, namely, service and freight rates. Of the two, the former is the most important, for with any curtailment thereof the producers find themselves burdened with overhead expense accompanied by the inability to secure sufficient cars in which to load and satisfy the demand for their products. Freight rates are more noticeable when orders are low and the competition of materials from other sources is more keenly felt.

The big interest of the producers is to place their materials in distant markets, and whether they are prevented from doing so by high freight rates or by an insufficient car supply, these retarding factors must be given careful thought and constant attention and action should be taken to secure for the industry the rights to which they are entitled.

"They have rights who dare maintain them" is a slogan which should be adopted by the industry as a whole and all join in a discussion of "how these rights may be secured." They should also lend their moral and financial support to securing the removal of any obstructions to a more efficient and prosperous business.

It is extremely difficult for a few companies to carry this burden, and even though great progress has been made in securing recognition of the great industry of producing mineral aggregates, there is a wide field for much greater accomplishments to be secured only through the united efforts of all interested.

Car Supply

During the year 1922 the industry has suffered severely from the effects of a serious shortage of open-top cars. At the beginning of the season it was apparent to many that this was to be a great year for the construction industry. While a coal strike loomed upon the horizon on April 1, and labor difficulties on the railroads were fast approaching a critical state, none could foresee the approaching disaster of a repetition of the 1920 fiasco and none thought that the Interstate Commerce Commission would take upon itself the responsibility of issuing another set of priority orders.

The action was taken, however, the latter part of July. The coal strike had been in progress about four months and the shopmen's strike a little less than 30 days. The railroads began to suffer from defective equipment and their inability to provide sufficient motive power to handle all the traffic which was being offered. As usual, the construction industry was picked out to bear the brunt of the deficiency in the transportation industry. Also the producers were called upon to suffer financial losses and to see the coal industry and manufacturers of non-essential articles prosper at their expense.

Almost immediately after the issuance of the priority orders, producers of the Southern district, in which are the non-union coal fields, began to suffer. In the Eastern territory, due to the continuance of the coal strike and the complete tieup of the coal industry, producers as a whole were able to supply a goodly portion of the demand. Service Order No. 23, which applied to the territory east of the Mississippi river gave the railroads no other choice than to furnish 100 per cent car supply to coal mines in preference to supplying open-top cars for the movement of other materials. They were also enjoined to give priority in the movement of coal and perishable freight.

At the same time, Service Order No. 24 was issued applying to the territory west of the Mississippi river. This order only provided that the railroads should give priority to the movement of coal and perishable freight. It said nothing about priority in the use of open-top cars for coal. But the railroads, suffering themselves from a shortage of coal and a lack of sufficient motive power, immediately took it upon themselves under the provisions of this order, to deprive sand, gravel and crushed stone producers of empty cars, and even though there was a surplus of idle cars, resting peacably on sidings here and there, a deaf ear was turned to the producers.

Complaints began to pour into Washington particularly from producers in Western and Southern states. Organizations immediately began to intercede with the authorities for individual and general relief for their members. Possibly the most active was the National Association of Sand and Gravel Producers, which handled over 100 of such complaints for producers of sand, gravel and crushed stone. Visits—sometimes two and three per day—were made to the offices of the Commission and the American Railway Association. Each time the situation in particular localities was placed before the authorities and the opportunity never passed by to inform the Commission of the protests which were being registered by the producers.

A general hearing was held in Washington in September as the result of a petition which was filed by the National Association. It is important to call attention to the kindly reception accorded to those present. The indifferent attitude toward the industry, so apparent during the year 1920, had completely disappeared. Recognition had been gained through organized effort, and this demonstrates what united effort will accomplish.

Several modifications were secured in the priority orders since July as a result of the representations which have been made. These modifications brought about considerable relief and to the various organizations responsible therefor are due the thanks from producers who have benefited by them.

We must now look forward to the year 1923. Reports again indicate a prospect of another coal strike for April 1. Meetings between the miners and coal operators have been held with no agreement in sight. The Coal Commission has taken a hand and has called the warring factions together for a meeting to iron out the difficulties. There must be no priority orders during the year 1923.

The Solution of the Menace

The solution of this menace is to deprive the Interstate Commerce Commission of the power to issue these orders which was given them under the transportation act. The rail-

roads had no difficulty in handling the problem before the World War because they knew they were compelled under the act to regulate commerce to distribute the transportation facilities without discrimination.

They escape the legal responsibilities while acting under orders of the Interstate Commerce Commission. Senate Bill 690, now reposing in the hands of the Senate Committee on Interstate Commerce, or a similar measure, will provide the cure. It must be reintroduced into both the House of Representatives and the Senate by members of those bodies, who will fight for its approval.

Producers can do much to help. Support should be given those organizations which are fighting for the rights of the producers. Interviews should be had with Representatives and Senators who represent them. Letters should be written calling attention to the discriminatory situation. Producers should enlist the aid of the consumers, local business organizations, and local papers in supporting the movement to place the construction industry on an equal basis with other industries in sharing the available transportation facilities.

A movement of much interest has been started in Illinois, where all the varied interests have combined into an organization which has been named the Illinois Construction and Transportation Association. Its aim is to prevent another repetition of priority orders for the future. The movement should spread to other states and should be the means of bringing sufficient pressure to bear upon Congress to take action. There should be no reason why—if producers will only support and help the organizations which are trying to help the industry—a better recognition of the rights of the shippers cannot be secured.

Freight Rates

The year 1922 witnessed a cessation of general interest in freight rates by the producers. After all, they are not so much interested in the level of rates so long as the proper relationship is maintained and consumers are willing to pay the freight. When cars are scarce and the consumers are clamoring for the materials it makes little difference to the producers whether the railroads collect 70 cents per ton for 50 cents worth of transportation, as long as they sell and dispose of their output. When orders are scarce a business depression exists, and the consumers are slow to invest their money and seek the cheapest means of obtaining materials, the matter of freight rates is of vital interest to the producers as they are then confronted with competition which is hard to overcome. Immediately they are brought to realize that they are paying a greater share of the transportation revenues of the carriers than they should properly pay as compared with other freight.

A Bit of Freight Rates History

Lest we forget, the freight rates on sand, gravel and crushed stone were increased 20 cents per ton by the United States Railroad Administration during June, 1918. On August 26, 1920, another increase of from 25 to 40 per cent was added. The National Association of Sand and Gravel Producers filed several complaints with the Interstate Commerce Commission during the latter part of 1921. The first of these, covering the central states, was heard by the commission during January, 1922. An elaborate presentation was made before Examiner Hosmer. At the same time, the commission was holding an ex parte hearing on the general freight rate situation, in which the national association participated.

The examiner, fearing to commit the commission to a policy, different than that which might be followed by the commission as a result of the general inquiry gave an adverse tentative report. Exceptions were taken to the report of the examiner and an oral argument made thereon before the commission. We are still awaiting its decision.

CRUSHED-STONE CONVENTION

EVERY owner, manager, superintendent and official of a quarry company in the United States should plan to attend the National Crushed Stone Association at the La Salle Hotel, Chicago, January 15, 16 and 17. Those three days are going to be big ones in Chicago—the Good Roads Congress and Machinery Show as well as the Crushed Stone Convention, will provide lots of new things for you. Make your hotel reservation immediately!

In July, 1922, the commission ordered a 10 per cent reduction in the level of all freight rates. On interstate traffic it gave some relief, but in many cases on intrastate traffic producers had already secured reductions greater than this amount through complaints filed with the state commissions.

The complaints covering the Eastern, Western and Southern districts have been placed on the suspense docket of the commission awaiting the decision in the Central states' complaint. The most noticeable reductions made in the intrastate level of rates during the year 1922 have occurred in Iowa, Minnesota and Michigan.

"How Much Will the Traffic Bear?"

Since the establishment of the transportation act, under which the Interstate Commerce Commission is permitted to adjust the level of rates so as to return to the railroads a given percentage on the valuation of their properties, it is not so much *what is a reasonable basis* as it is *how much will the traffic bear*. The commission seems disposed to rest its efforts on a level of rates, under which the traffic moves freely.

Thus we find them expressing themselves in their annual report which has just been issued, "Manifestly the existing rates are no longer interfering with the free flow of commerce as a whole," also, "the tonnage moving has been steadily increasing in recent months." May not this be an answer to the oft-repeated question, "When will the commission render its decision in the Central states' complaint?"

Two Pertinent Questions

Should not the producers look ahead to the time when orders are few and far between and when the competition of local materials is more keen? Is it fair that the increases made in the past few years on sand, gravel and crushed stone, and which have resulted in a return to the carriers of a greater proportion of revenues than other traffic is paying, be continued in effect as a general proposition? It seems logical to think that the revenues of the carriers will never exceed the net return, specified by the commission as operating expenses, may be increased by the railroads to absorb the difference.

A Wrong Comparison

The relationship of the rates on sand, gravel and crushed stone as compared with other commodities is wrong when we consider the favorable transportation characteristics of these heavy loading commodities, and while producers have been able to convince some of the state commissions of this fact, difficulties will always be experienced unless the interstate basis is brought down to the proper level.

Railroads seem disposed to oppose any efforts to secure general reductions in freight rates on road-building materials. We sometimes wonder whether it is due to the narrow-minded policy of opposing the good-roads movement, due to the fear that it will encourage the movement of traffic by truck instead of movement by rail.

We hear considerable agitation for a reduction in the freight rates on farm products only because the agricultural interests, through the American Farm Bureau, are constantly agitating the question of lower rates.

Producers of sand, gravel and crushed stone are paying more relatively than that paid on farm products, and as other interests succeed in lowering the level of rates on other commodities, the task is that much harder for producers of building materials to secure reductions. This is because of the greater inability of the railroads, if any exist, to stand wholesale reductions.

It would be interesting if the transportation events for the year 1923 could be forecast. Let us hope most sincerely that never again will producers have to endure the trying experiences of the past few years.

Cement Company Buys All Its Stone from Commercial Producer

Cape Girardeau Portland Cement Co. finds advantage in purchase of stone from the Edward Hely Crushed Stone Co.—Clay constituent from soft muck

AN example of the recognition that quarrying is an art in itself is the case of the Cape Girardeau (Mo.) Portland Cement Co. and the Edward Hely Crushed Stone Co. The cement company property adjoins that of the quarry company and crushed stone is delivered to the cement plant either in its own bins or upon a large stock pile.

This cement manufacturer recognizes that quarrying is a job for a quarryman, and realizes that he is fortunate in being in close proximity to such an experienced quarryman. The arrangement is satisfactory to all concerned because it assures the crushed stone producer of a certain volume at a comparatively steady rate of consumption and thus reduces his quarry costs, while the cement manufacturer gets the advantage of the larger quarry operation that is possible where a large volume of commercial business is done.

Plant of the Cape Girardeau Portland Cement Co., Cape Girardeau, Mo.

Quarry Operation

The most interesting part of the crushed stone operation is the quarry. Here a 110-ft. ledge of stone is being worked in three benches. As the views will show, the stone deposit is an outcrop, that is, a considerable portion of it lies above ordinary ground level.

Last winter the stripping up to the property line was completed; about 25 ft. of clay had to be removed and the hydraulic method was used. A long flume was run down into the river valley and the material was easily and cheaply washed away.

Two types of drills are in general use. The steam-operated Sanderson Cyclone well drill is used on the upper ledges where the bench is larger, and small Ingersoll-Rand air-operated tripod drills are used on the lower benches.

Blasting is done with dynamite and electrical detonators. Holes are located according to the characteristics of the ledge and a series set off at one time—the best results being obtained when two rows of holes are set off at one time. The upper bench is about 55 ft. high and at present has very nearly been worked to the property line. The second shelf, which is below the ordinary ground surface, is 30 ft. and the third is about 25 ft. deep. Narrow gage tracks serve each level and mules are used to transport material to the crushers.

Most of the material is hand loaded. A small Thew steam shovel has been used and is at present working on the lower level. The abundance of labor in the past has made hand loading preferable. However, the growing scarcity of skilled quarry labor has caused the company to seriously consider power shovels. One large shovel has been ordered which will be put into service early next spring. The stone breaks up in the initial blasting into proper sizes so that very little secondary shooting is necessary.

Plant Operation

The initial crusher—a No. 12 Allis-Chalmers gyratory—is mounted in the quarry 40 ft. below the normal ground level. This unit is driven by a 100-hp. motor powered by current from a local utility company. Rock is delivered to the crusher from three track levels. Stone excavated above the ground level is delivered in end-dump cars and a special device is used to dump the cars. A car of stone is rolled onto a special car tipple which holds the end gate with extended bars while the car is being dumped—on a pivoted section of track—into the crusher. The cars on the second and third levels are also end dumping and are

pulled up inclines to the crusher. Here they are emptied by the standard arrangement for this type of car.

The crushed stone is elevated to the screening plant by a Stephens-Adamson elevator 106 ft. high and the 1¼- and 2½-in. sizes are removed. The 1¼-in. stone is primarily for the use of the cement plant, but may be chuted to the stone plant's bins.

Material to be used at the cement plant is delivered by a long housed-in belt conveyor. At the cement plant a 500-ton storage bin and 25,000-ton ground storage are provided for receiving the stone. The haul from the rock storage to the cement plant is made by the cement company's own standard gage locomotives and cars, the rock being loaded from ground storage to cars by a 30-ton Ohio locomotive crane and clamshell bucket.

The company is now installing a storage conveyor bridge with 60-ft. ground clearance and 160-ft. clearance between spans—long enough to accommodate the largest conical pile of stone that can be built up under the bridge without having stone around the bottom of the supporting towers.

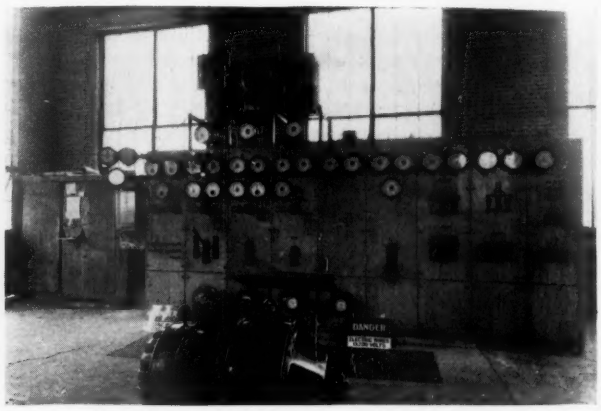
The rejections of the scalping screen are chuted to a No. 8 Allis-Chalmers gyratory crusher. The product from this crusher is elevated to a screen similar to the one serving the No. 12, and the same sizes are removed and rejections are returned to a No. 6 crusher of the same make. A third screen (jacketed) separates smaller sizes and also removes the agricultural limestone. Final crushing is accomplished by a roll-crusher which delivers the material to the same elevator which serves the No. 6 crusher.

The "fines" from the first two screens also are chuted to the third screen for the removal of dust. The No. 6 gyratory crusher and the roll crushers are used for further reduction of any size not needed. Six storage bins are provided so that commercial stone may be loaded directly into cars for shipment.

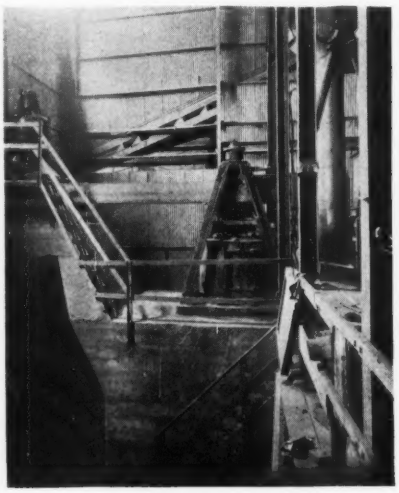
As the demand for agricultural limestone is increasing, a Jeffrey swing-hammer pulverizer has been installed. This unit furnishes a product ranging in size from ⅛ in. to dust. It is driven by a 60-hp. motor.

The plant has its own generating plant comprising primarily one 400-hp. O'Brien water-tube boiler, which supplies a Sullivan air compressor, a 250-hp. Westinghouse vertical compound steam engine, and a steam pump in the quarry. The crusher and elevator drives are so arranged as to permit a shaft-drive of the whole plant as a unit. Owing to the considerable distance of the lowest quarry level from the boiler room, some of the quarry drainage pumps are operated by air. In this instance it is considered better economy to use compressed air than to have such a long exposed steam line. The plant is owned and the operation is supervised by Norman Hely.

Ed Hely Crushed Stone Co. quarry furnishes raw material for cement manufacture



Switchboard in the boiler house. The instruments control the operation of the various departments



One of the Griffin mills and vertical motor drive where the finish grinding is done. Note peculiar foundation

Cement Manufacture

Limestone from the Hely quarry and a thick black alluvial clay from the flood plain of the Mississippi river are the raw materials from which the Cape Girardeau Portland Cement Co. manufactures portland cement. The limestone runs from 85 to 90 per cent calcium carbonate and the clay is of such composition as to give a fairly high silica cement. The stone is hauled the short distance in standard gage railroad cars and the gummy clay, excavated by a Brown dragline excavator at a pit three miles away, is hauled in 6-cu. yd. Western dump cars.

The clay is delivered from the cars to the hopper of an American shredding machine. Here the sticky mass is cut into small chunks and in order that the chunks will not stick together again they are sprinkled with raw-mix dust as they pass up the incline to the driers. This dust is the sweepings of the raw mill and the accumulation in the stack bases of the kilns.

Two coal burning Bonnot driers are provided to dry the clay and the limestone. The dried clay is hard and resembles shale. Six bins, each of a capacity of 1600 bbl., are provided. Two are for the dried clay and two for the dried limestone.

Control of the Mix

The mix is very accurately controlled by two automatically operated Richardson scales which are fed by gravity from the bins. The ratio of limestone and clay by weight is set on these scales and the material flows into each until the required weight is obtained. As the balance beam falls the gate is shut. When both scales are balanced, a gate in the bottom of each is automatically opened and the material is fed into a screw conveyor to be delivered to the grinders.

Raw Grinding

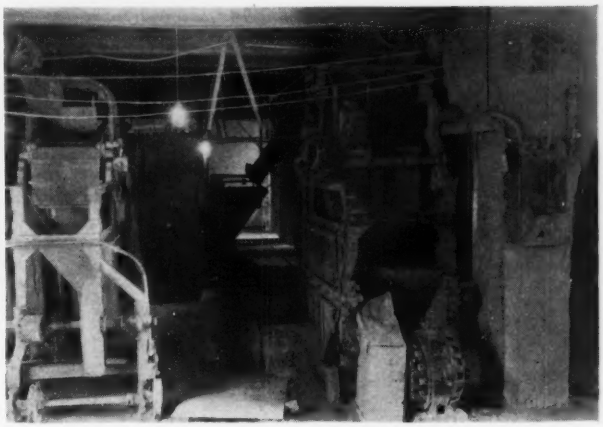
The grinding is done in five Fuller-Lehigh mills. Each mill is driven by a 75-hp. inde-

The Ed Hely Crushed Stone Co. plant. The preliminary crushing is done here. Storage is provided for underneath the conveyor belt trestle

Clinker storage, kiln house and waste heat boiler room. An overhead electric traveling and locomotive crane is used to distribute clinker

pendent vertical Wagner motor. An 8x24-ft. Worthington tube mill is also used on the raw end when two kilns are running. This is done by changing the screens on the Fuller-Lehigh mills so that they let through a coarser product to be reduced in the tube mill. The tube mill is driven by a 375-hp. Westinghouse motor which transmits its power through a silent chain drive.

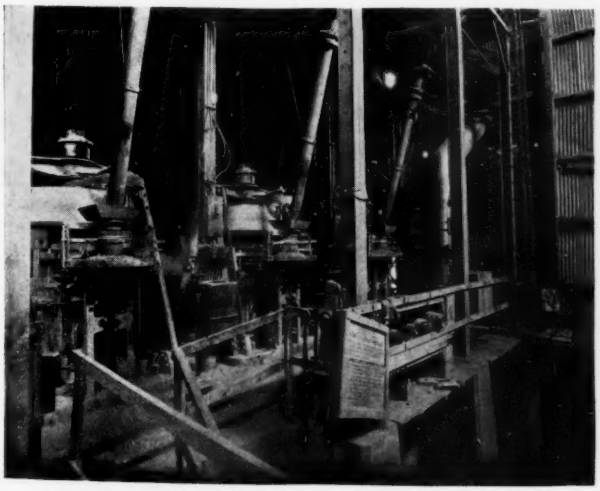
Spray pond where circulating water is cooled. The creek in the foreground supplies the water. Boiler and turbine house in rear



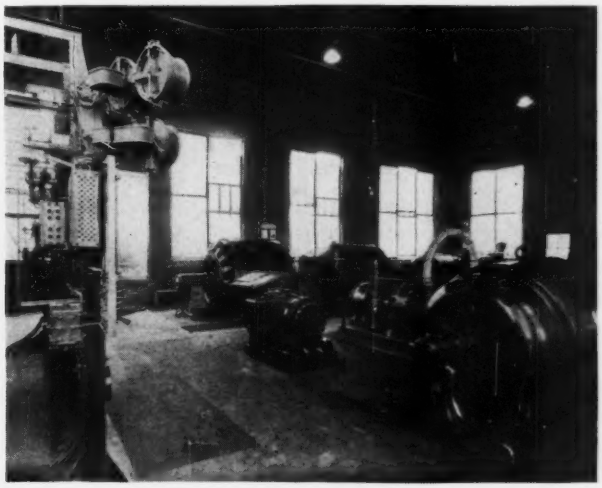
These two automatic weighing scales proportion limestone and clay for raw mix grinding. The scales are portable and are moved from bin to bin

Kilns

The clinker is calcined in two 9x130-ft. Chalmers & Williams kilns driven by independent variable speed Westinghouse motors. Coal is used for burning. The feed is regulated from bins above the kilns by screw conveyors connected with the kiln drive. The method used in removing the clinker from the kiln so that there is no necessity of a bucket carrier under the kilns, was described on page 47 of the January 3, 1920, issue of Rock Products. A bucket elevator picks the clinker up from the pit under the discharge end of the kiln and delivers it to a 25,000-bbl. capacity clinker storage. Here it is distributed or reclaimed by a traveling crane equipped with clam shell. The chains and sprockets of the hot



A battery of Griffin mills used for finish grinding. Each one has an individual vertical motor drive



Generating equipment consists of one 800- and one 1250kw. Westinghouse steam turbo-generators. A 150-kw. geared set is provided for use during shutdowns

clinker elevator are of manganese steel and have been in use six years without renewal.

Clinker is placed in and removed from this storage by a Case electric bridge crane with clamshell bucket. Clinker can also be taken from this storage and placed in another storage of 100,000-bbl. capacity. This is accomplished by either of two 30-ton Ohio locomotive cranes equipped with Haywood clamshell buckets.

Final Grinding

The final grinding is done in two stages. As the clinker leaves the storage a certain amount of gypsum in pebble form is added by a scale device and the product goes to a battery of five 40-in. Griffin mills, driven by individual 75-hp. motors. The second stage of pulverizing is done in the three Bonnot tube mills and the product is ground so that not less than 78 per cent will pass a 100-mesh screen. Both these and the tube mills in the raw grinding department use ⅞-in. white iron balls as the grinding medium. An elevator delivers the material from the tube mills to the packing house storage of 80,000 bbl. capacity. The storage space is divided into 14 compartments so that the product may be divided into batches of so many days run and tested prior to shipment. The packing house equipment includes two three-spout automatic Western valve bag machines. Cement is sacked as the orders are filled and so the sacked material in most cases is sent direct to the cars. A concrete warehouse is provided for the storage of bagged material so that in case of an unusual rush there is a reserve on hand.

Power Plant

The company generates all its own power, getting as much steam as possible from waste-heat boilers connected with the kilns, and making up the balance by burning coal under other boilers in the usual way. These coal-fired Heine boilers are of 273 hp. each, and the battery of four are the ones in use before the waste-heat boilers were put in.

There are two of these latter, of Heine make, each of 705 hp. and specially designed for this service. The waste heat installation of which they are a part will be described by Mr. Sonntag in his paper, which follows.

The steam pipe from these boilers is carried in a 330-ft. underground tunnel to the original power house which was enlarged to accommodate the additional equipment. This tunnel also carries the feedwater line to the boilers and the electric cables to the mill.

The generating equipment in the power house consists of one 800 and one 1250-kw. Westinghouse steam turbo-generator, with a 150-kw. geared set of the same make for use during shutdowns. The two larger machines exhaust into Westinghouse condensers whose circulating water is cooled in a spray pond and reused. As the temperature of the air in summertime is frequently over 90 deg., it is important to get the circulating water as cool as possible; at these times the water is resprayed by a motor-driven Heine centrifugal pump. The reason for this apparently complicated and expensive system of cooling is that the water supply of the plant is taken from a small creek whose normal flow is not sufficient for the condensers when used once only.

The feedwater is heated in an open heater and the usual feed pumps are installed. Although the water in the creek is not very hard the company is now putting in a Permutit water-softening system, in order to get the longest possible operation from the waste-heat boilers without cleaning.

Coal for the old boilers is delivered directly to the boiler room upon a slightly elevated track and is easily accessible to the fireroom floor. Coal for the kilns is first dried in a Bonnot rotary coal-burning drier and then reduced in four 30-in. Griffin mills. A screw conveyor is provided to deliver the fine coal to the kiln room where a suitable sized storage tank is provided for it.

The capacity of the Cape Girardeau Portlent Cement Co. is 2000 bbl. of cement per day. The officers are C. L. Harrison, president; John Tlapĕk and W. W. Fischer, vice-presidents; A. W. Harrison, treasurer; R. D. Harrison, secretary; A. C. Nielsen, auditor; C. H. Sonntag, purchasing agent and superintendent and J. G. Thompson, head chemist.

The Waste-Heat Boiler Plant of the Cape Girardeau Portland Cement Company

By C. H. Sonntag

Superintendent, Cape Girardeau Portland Cement Co., Cape Girardeau, Mo.

THERE are now about 25 member companies who are operating waste-heat boilers in connection with their kilns. Practically no two of these plants are alike. The number and size of the kilns, their arrangement with reference to the rest of the plant, and the size and location of the room available for the new boilers, are all matters that call for individual treatment. Further, some companies drive or force their kilns more than others do; some are wet-process and some are dry; and some, because of the nature of their raw materials must use more coal than others, so that the amount of heat sent up the stack per barrel of clinker and the temperature at which it is sent are not by any means uniform.

It would be impossible, therefore, to formulate a set of rules that would apply rigidly to a proposed installation. But experience, either our own or that of others, is a very good teacher. Many members who do not now have waste-heat plants will doubtless arrange to put them in in the near future as their advantages become more and more apparent, and so it was felt that a description of ours, with some details of its operation, might be of interest.

Our waste-heat boiler plant differs from most others in two or three particulars. First, it is one of two, and the only one west of the Mississippi river, that uses Heine boilers. The other is the Whitehall Mill, in the Lehigh valley. Second, it is the only one in which the gases pass through the boiler in the opposite direction to that used for coal firing. Third, the boilers are separate units with no common gas duct or cross connection between the ducts. The complete installation consists of two gas ducts, one for each of our kilns, two boilers, two economizers, two motor-driven fans, an underground concrete tunnel carrying the steam and water piping to and from our old power house, and instruments for indicating and recording the conditions of operation. I should like to discuss these separately and in some detail, and tell something of our operating experiences with them.

Gas Ducts

The gas ducts are directly in line with the ends of the kilns, the old stacks being offset. The ducts are 8 ft. wide, 7 ft. high, and 32 ft. long, their design being determined somewhat by that of the original stack base. They are lined with 4½ in. of Sil-o-Cel and 9 in. of firebrick and have arched roofs. The bottom of each duct consists of four firebrick lined hoppers, discharging into a 9-in. screw conveyor, which extends under the corresponding boiler and economizer. The dampers permitting the gas to go either to the old stacks or to the boilers should probably be considered as a part of the ducts. The original kiln stacks,

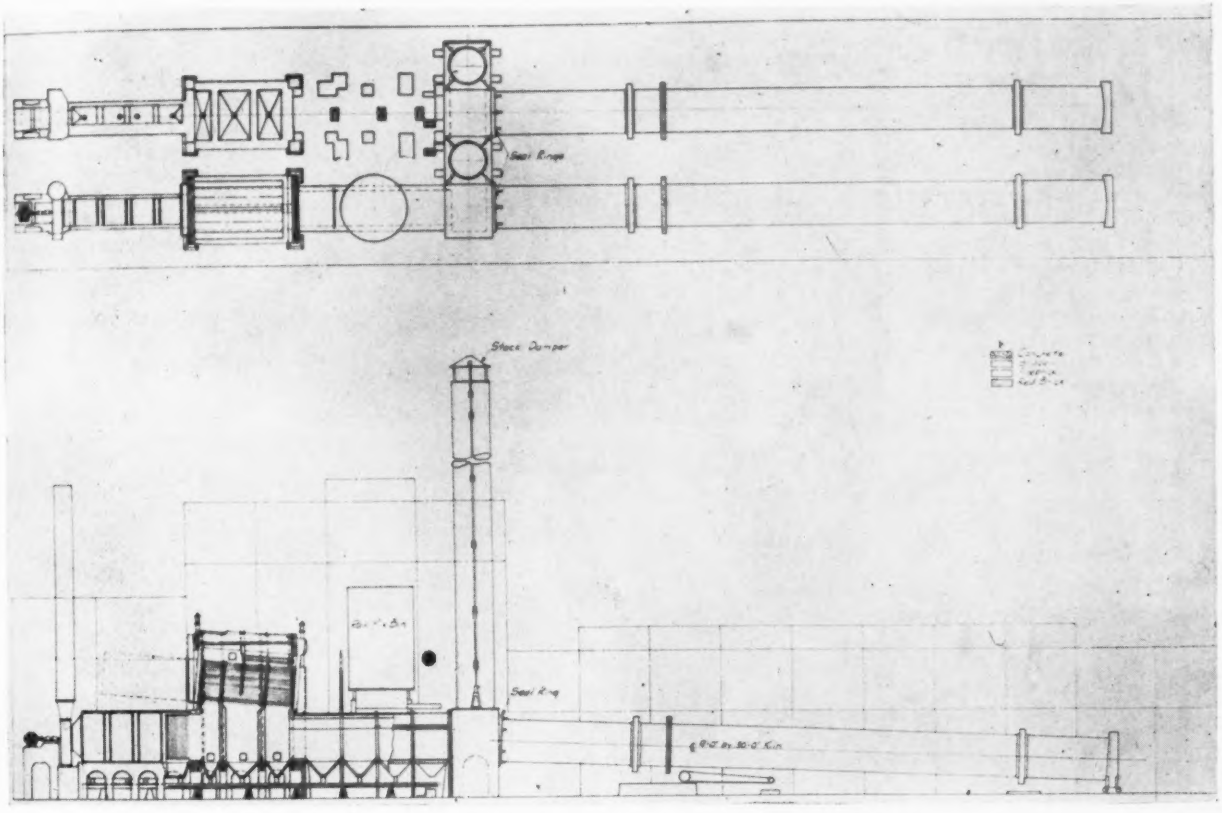
*Paper read before the Cement Mill Section, Portland Cement Association, twentieth annual meeting, Chicago, November 22, 1922.

which we have retained, are 8 ft. in diameter and 80 ft. high.

Some years ago, in connection with some experimental work we were doing with our kilns, we put dampers of the stovepipe type on top of these stacks. Our experience with them was not very satisfactory. Even at that height the heat was sufficient to warp them so that they finally became inoperative, and at times a high wind striking the exposed half of the damper would cause trouble with the kiln draft. Besides, they with special racks 54 in. long, which gives a maximum damper opening of 3 ft. 6 in.

These dampers were erected about eight months before the boilers, and were kept in the open position during that time with the kilns in operation. When the time for closing them came they were let down without trouble, and have since been operated several times without a hitch. We believe that they are a better solution of this particular problem than any movable partition in the flue can be.

45 deg. we find that much dust hangs on their sides and will not feed down to the conveyor. This has not gone to such an extent as to interfere with the operation, but it has made it not worth while to weigh the dust collected in an effort to ascertain the percentage of recovery. As this dust is red hot to weigh it would be a rather ticklish job in any event. We made no provision for clean-out doors in the sides of our ducts. We believe now that it would be well to have one on one side of each hopper so that



Plan and elevation of kilns, stacks, gas ducts and waste-heat boilers

could not be made very tight even when new, so that some other style of damper seemed desirable.

We finally designed a lid to fit over the top of the stack, to be raised and lowered vertically from its base. It consists of a conical cover made of 3/16-in. steel, somewhat like the old-fashioned candle extinguisher, but not so steep. Its edge is made of a channel steel ring with the flanges turned down, which rests on the edge of the stack when the damper is closed. The cover is raised and lowered by three operating rods consisting of 2½-in. pipe sliding in brackets attached to the outside of the stack. The part of these rods that is exposed to the hot gas when the damper is open is made of 3-in. round solid bars. These three rods are supported on the stack base by three common track or pump jacks

In operating a kiln without its boiler, some form of damper must be used between the kiln and the boiler. We put in a vertically moving sheet of 3/8-in. steel in the flue at a point near the boiler, and about 25 ft. from the kiln stack. We believed that this 25 ft. of duct would act as a pocket of dead gas to protect the damper from the direct action of the red hot gases. In this we were disappointed. The first time they were lowered they warped, and we had considerable trouble in getting them out again. We expect to replace them this winter with some form of refractory damper, and I hope that we may have some discussion of this point.

Before leaving the subject of gas ducts it might be well to mention the matter of caring for the dust that settles in them. While the hoppers under our flues have a slope of

the dust could be pushed down whenever it refused to slide.

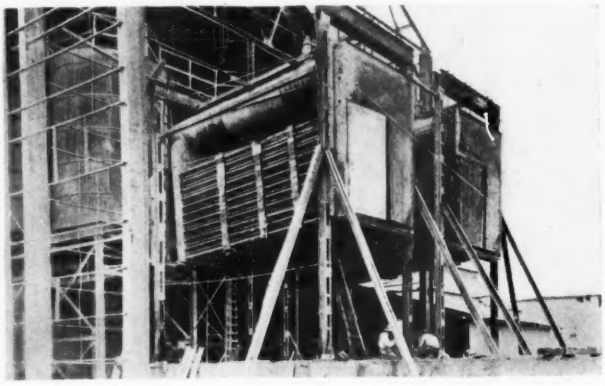
We originally intended to provide a cross connection between the flues, so that one kiln could be used with both boilers or both kilns with one boiler, or in case of operation at half capacity, either kiln could be used with either boiler. This would call for a damper in the cross duct to remain normally in the closed position, exposed to gas at the maximum temperature. This did not seem very desirable. Again, if the gases from two kilns operating at full load were to be passed through one boiler, the size of the induced draft fan and its drive would have to be greatly increased, and they would be operating the greater part of the time at fractional load which would be uneconomical.

There would seem to be no object in pass-

ing the gas from one kiln through two boilers, as its heat is abstracted in one boiler about as efficiently as may be expected, and probably not enough additional heat would be recovered in the second boiler to pay for operating the second fan. This leaves only the desirability of being able to operate No. 1 kiln with No. 2 boiler, or vice versa, during periods of reduced capacity. The chance of this being necessary is so remote that the additional complication to secure it is not warranted.

It is realized of course that this reasoning does not apply where a large number of kilns feed their gas into a common flue from which a large number of boilers draw their supply, and where in consequence the starting or stopping of a unit does not cause so large a percentage of variation, but in our case we are satisfied to have each boiler connected to its own kiln only.

Our dust conveyors are about 70 ft. long. When the red-hot dust is run through them they expand very perceptibly, and the steel trough has shown a slight tendency to warp. This caused no interference with operation, but if conveyors longer than this are used they should be provded with some form of slip joint to allow for expansion.



The two 705-hp. waste heat boilers under construction

Boilers

Our boilers are of the Heine type, designed for 100 lb. working pressure, rated at 705 hp. each, having double drums and 3½ in. tubes 20 ft. long, spaced considerably farther apart than the standard Heine construction to lessen the likelihood of dust bridging against them. The side walls are 26 in. thick, with 4½-in. Sil-o-cel built in. They are baffled for vertical passes, the gas entering and leaving the boilers below the tubes. This arrangement, besides giving very thorough contact of the gas with the tubes, permits the economizers and fans to be kept near the floor, favoring accessibility, and lessening the cost of foundations and buildings. In our particular case the gas enters under the low end of the boiler and leaves under the high end. By arranging things in this way, we were able to put a solid wall back of the boilers separating them from the kiln feed tanks, which are directly over the gas ducts. The space over the economizers is available for drawing out the boiler tubes whenever necessary. This arrangement also turns the front of the boiler toward the fans, and makes that end of the building a station from which all operations may be watched.

The dust is blown from the tubes by a hand steam lance operated through openings provided on each side of each pass. The end passes may also be dusted through the hollow staybolts in the headers. This is of special advantage at the inlet end, for twice we have had the dust build up into hard masses around the lower rows of tubes, and have broken these up and removed them by using solid rods through the staybolt holes, following this later with the steam lance.

The boilers are provided with non-return stop valves in addition to the regular hand-operated valves and the feed water is controlled by Copes regulators. We have had some little difficulty in properly locating the expansion tube for these, but having done this, the regulators have functioned without trouble of any sort.

Superheaters

These were made by the Power Specialty Co. and consist of steel U tubes covered with cast-iron flanges. They were designed to give 100 deg. superheat when the boilers are working at ⅔ rating. The flanges have proven to be excellent dust catchers, as they will fill up solid in a short time if not frequently cleaned. There is one point in connection with these superheaters that was overlooked by everybody concerned. The makers seem to prefer to put the manifolds at the cool end of the superheater, and because of the reversed gas flow in our boilers, they turned the manifolds toward the front. In the Heine boiler the drums have the same slope as the tubes, and there is not a great deal of room under them. It was therefore necessary to give the superheater elements the same slope, and the result is that they are not self draining.

They have caused us no trouble, probably because the velocity of the steam is high enough to sweep out any solid substance that may get into them, but there is a very evident danger of freezing if the boilers were shut down in cold weather with water in the superheaters. This could very simply be avoided by either reversing the superheater or by designing the boiler in such a way that there would be sufficient room between the water tubes and drums that the superheater could be set horizontally.

Economizers

The economizers are of Green make, each consisting of one hundred and ninety 9-ft. tubes and containing 2448 sq. ft. of heating surface. The tubes are vertical, and the construction is the manufacturer's standard in every way except that mechanical scrapers are not fitted. Each is set over a continuous dust hopper with partitions to prevent bypassing of the gas under the tubes, and this hopper empties into the same screw conveyor that runs under the boiler and gas duct. All the dust collected is returned to the kiln feed tanks. Each economizer, when receiving 100,000 lb. of gas per hour at 500 deg., is guaranteed to raise the temperature of 16,000 lb. of water per hour from 150 to 280 deg. F., the gases leaving at 390 deg. It is an interesting fact that the amount of dust adhering to the economizer tubes is self-limited, at least as far as our experience goes. It builds up on the windward side of the tubes in a sharp ridge until the rate of scour equals the rate of deposition, while the lateral and leeward side of the tubes remain comparatively clean. The economizer will hence maintain a very fair efficiency even if not dusted as frequently as one would at first think necessary. We have not so far had to make any tube renewals, and have had no other trouble except the blowing out of a few gaskets in one upper manifold.

Fans and Drives

The gases are drawn through the economizers by Green steel-plate fans with 7-ft. wheels having radial blades, operating at 575 r.p.m. and driven through flexible couplings by direct-connected 100-hp. squirrel-cage motors. We believed that these fans were somewhat larger than were actually necessary, and felt that some regulation of the amount of gas handled might be desirable, so we put multiple leaf dampers, somewhat like the old-fashioned window blind, between the economizers and fans, but made the leaves separately adjustable.

For reasons explained later we have not had occasion to use these dampers since the first warming up, but they seem to function very well. The use of a plain sliding damper at this point did not seem wise, because the large exposed area and the heavy pressure against it would make it quite difficult to move. There has been no noticeable erosion of the fan blades up to this time.

The reasons for using motors instead of steam turbines to drive the fans and

squirrel-cage instead of slip-ring motors may be worth going into. Measured along the pipe lines, our new boilers are over 400 ft. from our old power house. The old pumps and heater were large enough to heat and handle the water for the new boilers, and there was enough exhaust steam already available to heat it. Steam turbine drives, if used, would have had to operate non-condensing, and hence would be relatively inefficient, and their exhaust would have had to be vented into the air or piped back to the power house, where it was not needed through a long and expensive pipe line. Motors would get their power at the efficiency of the large generators, which had sufficient spare capacity.

In choosing between squirrel-cage and slip-ring motors the fan manufacturers were consulted, and they said the capacity of their machines could be controlled more economically by throttling at constant speed than by introducing resistance to reduce the speed, as considerable electrical energy would be wasted at fractional speeds. The greater simplicity of control was also considered.

Piping

Connection to our old power house is made through a concrete tunnel 7 ft. high, 6 ft. wide and 330 ft. long. Steam is carried in an 8-in. line with steel flanges, and feedwater in a 4-in. line. Expansion of both pipes is cared for by long radius bends, no sliding expansion joints being used. Overhead pipe lines would have been much cheaper, but the ground they would have had to cross was already in use as an outside clinker storage, with a locomotive crane working on it.

Instruments

Two Venturi meters measure separately the feedwater to the waste heat and the old coal-fired boilers. These work without trouble except that about once a year a piece of scale will lodge in the throat of the Venturi tube and make a cleaning-out necessary. Each boiler is fitted with a Republic steam flow meter with indicating, recording and integrating features. These have worked very well after the preliminary adjustments were made. A Wilson - Maeulen pyrometer outfit indicates and records for each boiler the temperature of the gas entering and leaving the boiler, and leaving the economizer. The records that this instrument makes are extremely interesting and instructive when considered in connection with the known operating conditions of the kiln.

The principal trouble we have had has been with the two high-temperature thermocouples, which are inserted in the stream of gas entering the boilers. The protecting tubes originally furnished for these were of calorized iron, and lasted only three or four months. After the protection tubes burned out the couples themselves failed also. We now have in use cast protection tubes, said to be made of an alloy or iron, nickel and chronium. They have not been installed long enough for us to say anything definite as to their life. Water and steam temperatures are measured by the usual mercurial thermometers, permanently mounted.

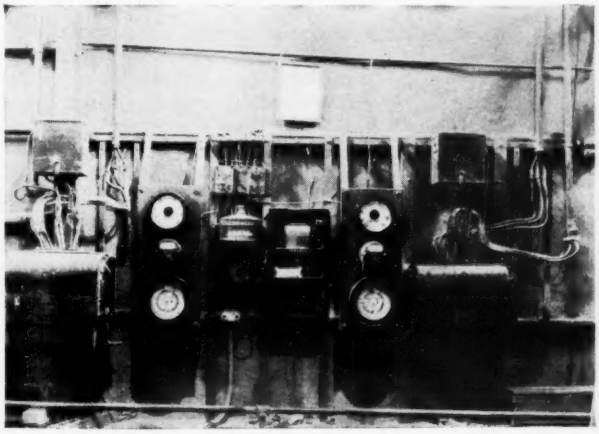
Economic Results

Before doing anything definite in the way of designing our boiler plant we installed a pyrometer in one of our kiln-stack bases in such a way that the thermocouple was directly in the path of the gases leaving the kiln before they were diluted and cooled by the air drawn in between the kiln and brickwork. This showed an almost constant temperature of 1550 deg. Since putting the boilers into operation we have fastened some sheet iron around the opening where the kiln projects into the stack base so that the annular space at this point is about 3 in. wide, but we have made no attempt to make a nearly air-tight seal because we were afraid that the higher temperature might injure the end of the kiln or the feed pipe. We shall be very glad to learn the experience of others on this point.

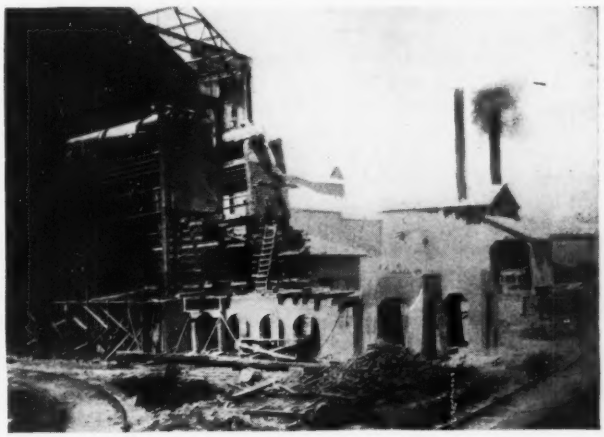
Of course there is considerable cold air being drawn in around the end of the kiln, with the result that the gas enters the boiler at about 1225 deg., leaves the boiler at 480 deg. and leaves the economizer at 360. Under these conditions we evaporated for all of this year to the end of October, 425 lb. of water per barrel of clinker produced. During May we were doing some experimental work and were not passing all the gas through the boilers. If we disregard this period, our evaporation has been at the rate of 467 lb. per barrel. If we succeed in maintaining a reasonably tight seal around the end of our kilns this figure should be very materially improved.

The power required consists of a 10-hp. motor driving the dust conveyors which run only two or three hours a day, and the two 100-hp. fan motors. These are operating at practically full load, although calculation of the weight of gas that should be passed based on the amount of coal and clinker handled calls for 85 hp. at the fan shaft. The excess is probably due to the air drawn in around the end of the kiln.

It is difficult to keep the kiln operators from occasionally turning on more coal than can be completely consumed in the kiln. The result is a carbon monoxide flame in the gas duct the gas burning with the air drawn in around the end of the kiln. We have recorded temperatures entering the boilers of 1850 deg. at such times. This happens only infrequently but when it does the excess coal is put to some use.



Instrument board in the waste-heat boiler room. An indicating and recording pyrometer records kiln stack temperatures



Waste-heat boiler plant during construction. Foundation in foreground is for economizers, fans, and stacks

Saves by Storing Cement

A SAVING of $30,000 was made by Wood county, Wisconsin, by providing a storage for 25,000 bbl. of cement early last spring. In this way all construction was greatly expedited and the concrete work was kept within the original estimated cost.

Advancement in Laying the Stone Down on the Quarry Floor

As resulting from the development of quarry drilling and blasting practice in recent years

By W. B. Garber
Sanderson-Cyclone Drill Co., Orrville, Ohio

THE subject of development of explosives has been given considerable publicity recently by a number of leading explosive manufacturers. Just as interesting is the development of drilling equipment, both of the piston type and the well drill type, the latter owing its origin to the Chinese drilling mechanism, with its more recent perfection to the discovery of oil and gas in this country about 70 years ago.

The general adoption of the well drill for quarry stone production on a big scale during the past fifteen years is quite familiar to all operators. This has probably been the biggest single advancement in quarry drilling and blasting in recent years and it is hardly necessary to explain or to go into detail concerning the advantages and economics of well drilling and blasting, now familiarly known as big blast-hole operation.

Since the adoption of big blast-hole drilling there have been many improvements, not only in the machinery employed, but in the system of operation as well, that will be mentioned in the following paragraphs. Progress has also been made in design and use of piston drills which still find quite a wide application for certain quarry conditions and rock formations

As it concerns a system of operation, the subject of drilling and blasting must be considered together. There are, however, certain features of drilling that have no bearing on blasting which are of great importance, and vice versa.

Big blast-hole drills of the well driller type have been steadily improved, both in design and construction. The light, flimsy water well drill first used for the purpose of experimenting with big blast-hole work, served its purpose in proving the worth of the new system, but it was neither strong enough nor of the proper design to take care of the every day, month after month, year in and year out, strenuous labor thrown on the equipment after it was generally adopted for quarry use. Manufacturers of drilling equipment at once realized the necessity of building stronger and heavier machines—machines that would stand the punishment of continuous operation and handling by inexperienced operators.

Most of the first well drills used in quarry work were steam driven or equipped with a steam engine operated by compressed air. Of the big blast-hole drills used today 95 per cent are either gasoline engine driven or electrically operated. The gasoline outfit has the advantage of being an independent operating unit and owing to the extreme simplicity of the engines furnished by most drill manufacturers, they require very little skill on the part of the operator in keeping them in good running order. However, electricity, where available, is the ideal power for big blast-hole drilling. It requires scarcely any attention on the part of the drill runner and in the majority of cases is by far the cheapest power to use. Occasionally, there are local conditions where a steam or compressed air outfit will give the best results but these are rather unusual.

Well Drills—Reducing Rope Wear

Manufacturers of drills in the past few years have been giving a great deal of attention to improving their machines so as to reduce rope wear. Hawser laid Manila drilling cable is used for operating the tools and its wear is one of the big items of expense in operating the big blast-hole drill. Care on the part of the drill man in handling the drilling tools will eliminate rope wear to a wonderful extent. The tendency of most drill runners is to allow too much slack in the rope, which causes a whipping action that burns out the inner strands of the rope. It is almost impossible to run the drilling tools with too tight a rope as long as the drilling tools are hitting the bottom of the hole and the danger of ruining the rope in this way is one to one-hundred of the chances when running it too loose. The purchasing of good drilling cable is of utmost importance. Good drilling rope costing two to three cents more per pound than other rope in the market will outlast two of the cheaper ropes. There are also several little kinks that result in the saving of drilling rope. One that might be mentioned is the wrapping of an old piece of belt around the layers of the coils of the rope on the drilling cable drum which prevents the upper coils from wedging down between the lower coils.

Importance of Sharp Drills—Progress in Well-Drilling Hard Rocks

One drilling accessory that has been responsible for increased efficiency in big blast-hole drilling is a patent well drill bit sharpener placed on the market about two years ago. This bit sharpener, due to the fact that it makes a bit with a uniformly shaped cutting edge, has increased footage and is a vast improvement over dressing bits by hand, as there are no two blacksmiths who will dress a bit alike and, again, there is no one blacksmith who will dress two bits alike. The bit dresser saves a great deal of time in sharpening bits and always insures an ample supply of freshly dressed bits which is an extremely important factor in quarries using several blast-hole drills.

In the last four or five years a great deal of progress has been made in drilling extremely hard rocks with well drills. A few years ago the drilling of rocks such as quartzite, granite, ganister and some trap rocks was considered without the province of the big blast-hole drill. A number of such quarries found no other methods of stone production commercially profitable until they installed big blast-hole drills. Some of these formerly operated by the snake hole method, others with tunnel shots, while still others used random methods of getting the rock down.

One of the difficult problems offered in drilling these hard rocks has been solved by using large drill bits and starting holes of large diameter at the top and allowing the diameter to decrease as the hardness and abrasiveness of the rock causes the gage of the drill bits to wear down. For example, a quartzite quarry in Minnesota operating a 70-ft. face, start

their holes 8 in. in diameter at the top and allow them to decrease to 5½ in. at the bottom; 11 ft. per 10-hour day is considered good footage in this quarry. In a New Jersey trap rock quarry, operating a face 130 ft. high, 8-in. holes are carried the full depth of the breast in order to overcome the tendency of drifting off in seams and crevices with which this rock abounds.

Advantage of Experienced Drill Men

It is well to say a word about the labor element in big blast-hole drilling. Where only one or two drills are operated in a quarry, it will pay to have them in charge of intelligent, energetic and fairly skilled men—men who possess a certain amount of initiative. Such drill men are well worth the dollar or two extra per day necessary to keep them on the job. Where a fleet of drills are used in a quarry, a little lower class of labor may be employed on the individual machines but the drills should be in charge of a drill foreman who himself is a skilled drill man. In big blast-hole drilling, the periods of hard and heavy labor do not come often but when these periods do come, the drillers should move fast and exert themselves to the utmost. Some quarries have found it pays to place the drill men on a bonus basis for over a certain amount of footage made per day. Such a practice is all right providing the men do not neglect the upkeep of their machinery and tools in their efforts for speed.

The Place for Piston Drills

The province of the piston drill with its small blast holes is now generally conceded to be for low quarry breasts, 15 to 20 ft. in height where the rocks are heavily brecciated, requiring rather close spacing of the drill holes and a thorough distribution of the explosive in order to produce the proper shattering effect. Other work for the piston drill is for snake holing and secondary drilling where well drills are used. There are some instances where a piston drill can be used more successfully than a well drill on 30 to 35-ft. vertical holes. Such cases, however, are quite the exception. There have been many improvements in piston drills both of the small and large types during the last three or four years. This applies to the mechanism of the drill itself as well as to the steels and steel sharpeners.

Powder for Well-Drill Holes

The use of large cartridges for loading in big blast holes is quite prevalent. Sticks up to 5 in. in diameter may be had from stocks and even larger cartridges on special order. Due to the fact that the large cartridges nearly fill the bore of the hole, little tamping is necessary and loading is greatly facilitated.

Electric blasting caps, electric firing and the use of Cordeau fuses represent other advancements in blasting practice in the last decade. Cordeau is recognized as giving the best results yet attained in well drill blasting and tunnel work. Being insensitive, ordinary shocks, friction or fire will not set it off. Misfired holes with Cordeau are very few.

Quarry Working Face

A 35- to 45-ft. working face has proved to be the most economical and efficient height of breast for steam-shovel loading although 60- to 100-ft. breasts are worked satisfactorily. On 35- to 45-ft. faces, buffer shooting can be done without piling the stone so high as to endanger the operation of the shovel.

Buffer shooting consists of allowing the broken stone brought down by a previous blast to stand against the breast until after the next blast has been made. The broken stone furnishes a pressure when the new blast is made which tends to create a resistance in front of the drill holes that approaches the resistance back of the holes, thus causing a more thorough penetration and shattering effect. The stone is so piled that a single shovel cut and track laying will load the broken stone from one blast. The buffer also prevents the blast from hurling stone out into the quarry yard where it might bury tracks, damage equipment or increase the cost of loading.

On breasts higher than 45 to 50 ft. a buffer shot tends to pile the stone higher than can be handled safely by the ordinary sizes of shovels now used in the average quarry (60- to 100-ton shovels). However, on the higher breasts, the economies of big-hole blasting—considering drilling and blasting costs only—are often so great that they offset extra track laying and two or more cuts by the shovel.

Tendency Toward Larger Shovels

An interesting development that is now going on in some of the larger quarries and open pit mines of the country is the use of enormous revolving shovels with 6- to 8-yd. buckets on higher faces (80 to 100 ft.) These shovels were originally designed for stripping work in the coal fields and metal mines, where the service is not quite as severe as in stone quarries with the result that it has been found necessary to strengthen these shovels in order to make them adapted to quarry work.

A limestone quarry in Michigan is using shovels of this type on a 90-ft. breast which was formerly worked in two 45-ft benches with smaller shovels. Present practice seems to indicate that these revolving shovels with their extremely long booms and dipper handles will load stone from high breasts at costs equal to those of smaller shovels on 35- to 45-ft. breasts with even lower ultimate per cubic yard or per ton costs because the somewhat lower drilling and blasting costs in working high breasts, and furthermore, that buffer shooting with its advantages can also be employed.

A few quarries having extremely hard rock that is seamy and creviced or otherwise hard to drill with well drills where the deposit was formerly worked with high face, have lowered their costs by reducing the height of the working face to 35 to 50 ft. and working in one or more benches, each bench, of course, being an independent working floor.

Very High Quarry Faces

A number of open-pit mines and quarries in the West economically carry working faces of great height, 150 to 250 ft., by a combination system of operation consisting of well-drill holes and snake holes. The well-drill holes are drilled approximately two-thirds the depth of the cut and sprung several times with dynamite. Snake holes are drilled into the toe of the breast to depth equalling the burden on the front of the well-drill holes, and are also sprung. Powder is usually employed for the final charge instead of dynamite. The result of such a shot is a new working face with a slope of 60 to 75 deg. from the horizontal. The broken stone lies in such a position that there is no danger of it sliding and burying the shovel. The drilling and blasting costs are extremely low with this system of operation.

"Individual Plant Progress"

The greatest progress in drilling and blasting during recent years has been what may be termed individual plant progress. By this is meant, the solution of the drilling and blasting problems of each particular plant after a careful study of the various factors involved and experimenting with different methods and systems of procedure until all the stone producing operations are so balanced that the final cost of the manufactured product is the lowest possible with the equipment at hand or available. This may often mean the sacrificing of lowest attainable costs in drilling and blasting in order to take care of other conditions in the production schedule.

The ultimate aim in a drilling and blasting program is not the lowest drilling cost per foot, per cubic yard or per ton, nor highest ratio per unit of material blasted to the pound of explosive consumed, but rather, the lowest cost per ton or per cubic yard of the finished product aboard cars. This finished cost includes not only drilling and blasting, but loading, hauling, crushing and overhead, all of which are affected by the manner in which the drilling and blasting are done, regardless of the cost of the latter.

There are no two quarries anywhere that possess exactly the same conditions. These conditions may be briefly outlined as follows: (1) Hardness and character of rock; (2) Structure of rock; (3) Depth of workable deposit; (4) Height of working face; (5) Nature of finished products; (6) Method of loading and kind of equipment; (7) Size of crushers. It is obvious that there are so many combinations of conditions possible that no set rules could be made, even from standpoint of drilling and blasting practice.

A quarry operator should not be satisfied until he has tried several systems, that is, different spacings of drill holes, various methods of loading the holes and perhaps different strengths of explosives, assuming, of course, that the method of drilling and size and type of drilling equipment has already been pretty accurately determined.

Stronger, Lighter Aggregate

AGGREGATE producers in Kansas City, Mo., have been giving some consideration recently to a competitive aggregate known as haydite, which has been used with apparently complete success in a number of construction jobs, both buildings and bridges.

This material has been made and used for about five years to replace sand, gravel and crushed stone, but it is only recently that any extensive plans for increasing the general use of the material have been made.

This new aggregate consists of clay or shale burned by a patented process in a rotary kiln, then crushed and screened to suitable sizes. In effect it is bloated brick, formed by burning the clay or shale at 1800 to 2000 deg. F. This causes the formation of gases which, in expanding, fill the clay ball full of holes and bloats it to several times its original size.

The resulting product is similar to crushed limestone in color, but it is much lighter in weight than the ordinary aggregate. A cubic yard of this material weighs 1600 to 1700 lb., compared with 2500 to 2700 lb. for the cubic yard of most sand, gravel and stone. A cubic foot of concrete made with haydite weighs 95 to 110 lb., as against 140 to 150 lb. for a cubic foot of stone concrete.

This lightness in weight is probably its principal advantage. Because of it the dead weight of structures where it is used will be considerably reduced, especially in tall buildings, and in reinforced concrete construction the steel members can be proportionately reduced. Figures have been compiled to show that the saving in steel and cement, over and above the additional cost of the special aggregate, will amount in some cases to 25 to 33⅓ per cent. This is when stone and sand are figured at $2.75 a cu. yd. and haydite at $6 a cu. yd.

Tests of haydite concrete have been made to determine its strength, at the United States Bureau of Standards and at other testing laboratories, and these tests seem to show uniformly that concrete made from this new aggregate is stronger than stone concrete, various tests showing the increased strength to be from 10 to 30 per cent. This is in spite of the fact that the aggregate itself is a comparatively weak material.

Part of this increased strength in concretes of equivalent mixes may be attributed to the presence of a small amount of fine material in the haydite—from four to eight per cent passing the 200 mesh, and eight to twelve per cent passing the 100 mesh. This fine material mixed with the cement acts as a cementing material to give a stronger concrete with the same proportion of cement.

Another advantage of this aggregate is that, since it has already been burned at a high temperature, it is more fireproof than limestone when used in concrete.

In preparing the burned material it is passed through crushing rolls, then screened into two sizes—from ⅛ in. to ¾ in., and from ⅛ in. down—and the two sizes mixed in certain proportions and this mixture delivered to the job ready to add the cement and water. The coarser grade corresponds to gravel or crushed stone, the finer grade to sand.

The plant making haydite at Kansas City is producing 115 yards a day in a 6-ft. by 40-ft. rotary kiln, using oil as a fuel. At present this is the only plant in operation, but it is planned to open another plant at Des Moines in the spring and plans are under way to license the manufacture of this product at a number of places throughout the country.

Illinois Opens Bids for 193 Miles of Roads

PART of one of the most extensive road programs ever planned by the state of Illinois was executed on December 21 when 400 bids, on 193 miles of new paving in 27 counties, were opened by the State Division of Highways.

The total cost of the work involved is estimated at approximately $5,650,000, and is to be completed during 1923. There were more than 200 contractors present when the bids were opened.

Universal Gypsum Co. Takes Over Two Companies

THE Universal Gypsum Co., a $4,000,000 corporation incorporated under the laws of New Jersey, has completed negotiations for the purchase of the Plymouth Gypsum Co. and the Iowana Plaster Co., both of Fort Dodge, Iowa.

The plants of these companies are said to be two of the largest calcine plants in this country and the purchase of them will give the Universal the largest output of any company. It is reported that the company has planned to take over other properties in Ohio and Texas.

The president of the Universal is W. E. Shearer, who, with the other officers and directors are men of long experience in the gypsum industry. Other officers are: C. E. Williams, vice-president; J. A. Henley, treasurer, and J. F. Haggerty, secretary. These officers and the following, will comprise the first board of directors: Norman E. Hough, formerly manager of the Hydrated Lime Bureau; L. E. Armstrong, Oliver Mitchell, Martin Johnson and J. J. Gorman.

Yankee Cement Driven Out

ACCORDING to a dispatch from Claude O. Pike, special correspondent of The Chicago *Daily News* foreign service at Rio de Janeiro, Brazil, American-made cement has been driven from warehouses and construction jobs throughout South American countries. This is caused, it is said, by various European countries delivering cement at prices that United States manufacturers cannot compete with.

The dispatch reports that even a Brazilian-owned cement plant located at Sao Paulo, the industrial center of the country, has been forced to shut down on account of being unable to meet the European prices.

After a careful survey of the industry in South America and Europe, American manufacturers say there is no hope of selling their products in South American countries until Europe recovers from its financial depression. They claim that the high wages paid in the United States and the high freight and steamship rates are the two main reasons why they cannot compete.

Annual Convention Indiana Sand and Gravel

THE eighth annual convention of the Indiana Sand and Gravel Producers Association will be held at the Claypool hotel, January 10 and 11.

A splendid program for the two days has been arranged and all members are urged to attend.

Progress in Blasting

By employing scientific methods and making careful calculations in blasting, quarry operators throughout the country are accomplishing a great deal towards eliminating waste in the rock products industry

By N. S. Greensfelder
Mining Engineer, Hercules Powder Co.

As proof of the progress being made in quarry operation let us take the example of a certain large producer of crushed stone. This company, operating more than a dozen quarries, plans its work almost a year in advance. Officials of the company make a tour of inspection in the late winter or early spring and decide how each of their quarries can be worked to best advantage during the year. They are followed by an engineer, who by careful surveys, lays out the drill holes. The quarry superintendents are consulted, of course, but the work is laid out from the standpoint of the company's operations, as a whole.

An 80-ft. face in an eastern Pennsylvania quarry; where 51 holes loaded with 11 tons of dynamite were fired simultaneously to bring this down

The same is true of the blasting. All large shots are fired under the supervision of a chief blaster. The varied experience which this man gains by his observations at the different operations enables him to keep blasting costs lower than would be possible if a different man had charge of the blasting at each quarry. The results obtained by this company prove conclusively the necessity for careful plans, properly carried out, to maintain low production costs. If the large companies find that it pays to follow a plan of this kind, it is certainly wise—even absolutely essential for the smaller operation to do likewise.

Selection of Suitable Explosive

The selection of the most suitable explosive is an important step in the elimination of waste in blasting. Perhaps the oldest type of dynamite now in commercial use is straight nitroglycerin dynamite. Where a quick, smashing, and fairly water-proof explosive is needed, straight nitroglycerin dynamite can be used to good advantage. Its high rate of detonation produces a shattering effect that breaks the rock in small pieces and keeps secondary blasting at a minimum. It is a good explosive for mud capping because of its quick shattering action.

An explosive that has been used in underground work for years, and which has also a wide use in quarries, is gelatin. It is dense, plastic, and water-resisting. Gelatin can be safely loaded in wet holes and because of its density a concentrated charge can be placed at the bottom of the hole or at any other portion of the hole where desired.

Extra, or ammonia, dynamite costs a little less than gelatin and where it can be satisfactorily used is an excellent quarry powder. It is not so water-resisting as gelatin and is a little bulkier.

During the last two or three years many quarrymen have come to see the economy of the bulkier explosives, such as Special No. 1. There are about 35 per cent more cartridges of this explosive per case than there are of ordinary dynamite. Special No. 1 usually replaces 40 per cent dynamite cartridge for cartridge, yet costs about 25 per cent less per cartridge. This explosive contains only the highest grade of standard materials and by wide use at many quarries it has proved its dependability.

Under certain conditions black blasting powder is the most economical to use. Where a quick, shattering explosive is not necessary to break the rock to desired size, lowest costs can often be obtained with black blasting powder. The wide-awake operator, interested in preventing waste, should at least consider whether blasting powder is adapted for his work.

Distribution of Explosive in the Hole

Another important consideration is distribution of the explosive in the drill hole. This can not be determined by any rule or formula; but a careful study of the most advantageous spacing of the explosive charges in the hole will often result in lower costs. The charge should generally come to at least 30 ft. from the top of the hole, no matter what its depth; in the harder formations it is well to bring it 20 ft. from the top. In deep holes better results can be obtained by breaking the charge in one or more places, filling the intervening spaces with stemming.

Where there are a number of holes in a line, it is often advisable to stagger the explosive charges—that is, to place stemming in one hole at the same level as the charges in adjoining holes. The character of the rock strata should determine the location of the breaks. The explosive charges should be placed at the level of the hardest formations. The total charges

required for holes 100 ft. deep is seldom over 800 lb. and may not be more than 700 lb. It is often advisable to use a higher strength dynamite at the bottoms of the holes, in order to concentrate sufficient breaking force at the bottom. Distribution of the charge in the holes is an important item, and the blaster interested in eliminating waste will give it consideration.

The 80-ft. face after the shot. It was estimated this one blast brought down 80,000 tons of stone

Increasing Use of Cordeau

One of the principal advances in quarry blasting that has been made in recent years is the ever increasing use of cordeau for firing blasts. Cordeau consists of a carefully drawn lead tube filled with trinitrotoluene. An extremely violent shock, such as that produced by a blasting cap is required for its detonation. The average rate of detonation of cordeau is about 17,500 ft. per second; when it is placed along an explosive charge the entire column is detonated at a rate equal to that of the cordeau. This increases the shattering effect of the explosive and consequently decreases the necessity of secondary blasting.

When the explosive charge is not continuous but is placed at different points along the hole, cordeau furnishes a particularly convenient and efficient means of firing. The charge can be broken as many times as desired, because the cordeau extends along the entire length of the hole, and therefore detonates all of the explosive. If elecric blasting caps are used in firing non-continuous charges, it is necessary to place a cap in each of the separated sections, and to connect each of the caps to the firing circuit, an operation that consumes considerable time. It is quicker, simpler, and surer to use cordeau.

An Ohio company found that cordeau has reduced their blasting costs. This company now uses cordeau for all primary blasting in churn-drill holes. Missed holes have been almost entirely eliminated. They find that in certain cases the amount of explosive necessary has been reduced more than 10 per cent by replacing electric blasting caps with cordeau.

Blasting With Big Charges

At a Western operation where churn-drill holes are first chambered by dynamite and then loaded with black blasting powder cordeau has also demonstrated its ability to prevent waste. At first, waterproof fuse and No. 6 blasting caps were used. These were replaced by No. 8 electric blasting caps; now cordeau is used exclusively. It has been found that the holes can be loaded more quickly and with greater safety with cordeau and the danger from unexploded caps and powder in missed holes has been eliminated.

The tunnel, or coyote-hole, system of blasting is found to be the most economical at many large quarries in California and other Western states. This consists of driving small tunnels into the quarry face and running cross-cuts at right angles from the ends of the tunnels. The explosives are placed in pockets made in the bottom of these cross-cuts, and the tunnels are back filled with rock. All of the charges in the various cross-cuts are fired simultaneously. The total charge has been calculated to break out the rock at the base of the face, after which much overlying rock falls from its own weight. This system of blasting is particularly well adapted to the trap rock and much of the limestone found in the Far West. It is also used in some Eastern trap rock quarries. In one shot made at a large quarry in California 356,000 tons of rock were broken in one blast. More than 100,000 lb. of explosives, consisting of black blasting powder and R. R. P. were used to make this one shot.

The amount of money involved in a blast of this kind is so great that the very best advice possible should be secured before driving the tunnels. There are many men in the explosives business who have had long experience in blasting of this kind and have made a special study of it. It is usually advisable to consult with a man with this experience before starting a large tunnel shot. Many quarry operators avail themselves of this service given by the manufacturer and find that it pays to do so.

The tunnel, or coyote-hole, system of blasting. Recently 51 tons of dynamite and powder were carried into tunnels similar to this one in a California mountain. It is said that when the charge went off the mountain was completely lifted and dropped

Hand-Hammer Type of Power Drill

The improvements made in the jack-

hammer type of drill during the past few years have brought it into use at many quarries. In addition to its adaptability for block-holing, it is well suited for the benching system of quarrying, either where the face is too low for well-drills or where for some other reason benching is decided upon as the most desirable method to follow. In some quarries the stone varies so much that it is necessary to sort the blasted material. Even though other conditions may be favorable for well-drills, the benching system is desirable in such a quarry.

The jackhammer type is a very fast driller—200 to 250 ft. a day is not uncommon on continuous work. Only one man is required to operate the drill, and with hollow steel the hole is kept clean of cuttings. Even though it may be necessary to space holes closer with these drills, they drill so much faster that a lower cost per ton can usually be obtained than with a tripod machine. At a large limestone quarry in New Jersey where jackhammers are used both for primary and secondary blasting, an average of 250 ft. per drill per day is maintained without difficulty. The holes for primary blasting are drilled about 20 ft. deep, on from 5- to 6-ft. centers. When the holes are properly loaded, little secondary drilling is required.

At a Connecticut trap rock quarry jackhammers recently replaced the old reciprocating type of piston drill. If the operator on the piston drill drilled 25 ft. a day it was considered a very good day's work of 9½ hr. Using a jackhammer, it was found that 96 ft. could be drilled, in fitchery ground in 9 hr. This represents over three maximum days' work with the piston drill.

Drill Sharpeners

Drill sharpeners are also helping to reduce drilling costs at quarries. At one quarry the introduction of a drill sharpener saved the company the wages of two men, a total of $6 per day. Since the sharpener was installed, there has never been a time when there was not from 300 to 700 pieces of sharp steel available in the quarry for immediate use, whereas when sharpening was being done by hand, there were usually two or three machines standing idle, waiting for steel.

The well-drill, or big-hole, system of blasting continues to grow in favor at quarries where conditions are suitable for its use, and this includes the majority of those producing limestone, shale, and other sedimentary rocks. Well-drilling is replacing snake-holing in some of the eastern trap rock quarries, with the development of types of well-drills that are able to stand up under the punishment of hard rock drilling. One of the principal advantages of well-drilling over snake-holing is the elimination of springing the holes, a costly operation, both in time and materials.

Evidence that 1922 has been a more active year for the quarry industry than 1921 is given by the increase of more than 12 per cent in the volume of the sale of explosives for quarry purposes over that of last year. Dynamite prices have been reduced from 20 to 25 per cent below those of 1921. The prices of blasting supplies of all kinds have also been appreciably reduced.

There has been a noticeable increase in the selection of the most economical explosives for the work at hand and the adoption of the most up-to-date methods of firing. Many quarrymen, along with the producers of other essential materials, are wideawake to the necessities of the times and are doing their part in the elimination of waste in industry.

National Slate Industry Meeting

THE slate industry will hold meetings at the Commodore hotel, New York City, on January 22 and 23, under the auspices of the National Slate Association.

Dr. Oliver Bowles of the Bureau of Mines, will preside at the opening session which will be devoted to an exchange of experiences by producers on production and new uses of slate.

At this meeting President Keenan will announce the winner of the prize for the best slogan and insignia. Two prizes of $100 each will be given—one for a slogan, the other for an insignia

Everyone in the United States connected with the slate industry, whether a member of the National Slate Association or not, is invited to attend the meetings. Opportunity will be given equipment manufacturers for demonstration of any new apparatus or methods, which are applicable to the slate industry.

Detroit's Sand Scow Fleet

WHO remembers the large fleet of sand scows that traded at Detroit, hauling sand and gravel from Lakes Erie and St. Clair? asks A. B. McLearen, in the *Detroit News*. These little sailing scows had to pick up their loads by loading the sand and gravel into wheelbarrows, the crews shoveling it from the water. The wheelbarrows were then pushed up a runway consisting of two planks. It would take five or six days to load. When the boat was full it would be moved to deep water and the coming of the wind awaited.

The mountain after the shot. This huge blast was made by a California cement company and is considered one of the largest ever made in the West. The explosion covered a distance of a quarter of a mile.

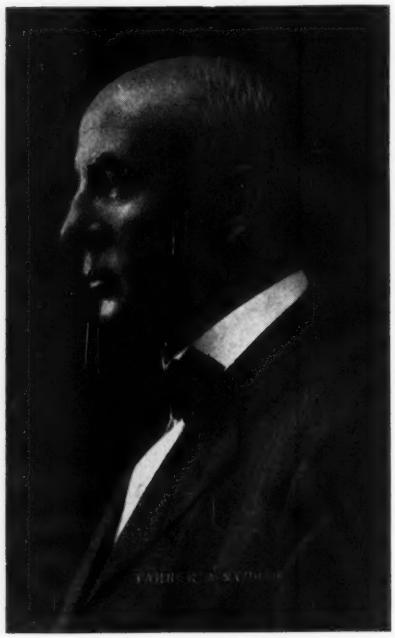
The scows brought their loads to F. B. Sibley, Gutoek & Heiden, C. J. Weiser and Eberts Bros. I have seen as many as 10 unloading and 10 more waiting for a chance to get to dock.

Along in the 90's many of these boats installed engines.

I remember that often the scows became windbound and Captain Ruelle would go out with his tug, J. L. Miner, pick up 10 or 12 and tow them to the lake. It was a fine sight to see the scows cast off their tow lines one by one and head under sail for their loading grounds. The present sand-suckers can load as much in as many hours as the old scows took days.

Conditions in the Missouri Valley

PLENTY of cars, no orders; plenty of orders, no cars. That describes, briefly, the conditions during the 1922 season as reported by producers of various districts in the Missouri Valley Association of Sand and Gravel Producers. The annual meeting of the association, held in Kansas City December 14 and 15, was well attended, and as usual brought out a great deal of frank, free discussion on important topics.



Harry E. Moore, President

Production figures for the 12 months ending September 30, 1922, show a decrease of 54,000 tons from the production of the corresponding period a year earlier. This is approximately a 5 per cent decrease in output. At the same time the average price decreased 2.6 cents per ton, while plant operating expenses decreased 6.9 cents per ton.

Concerning next year's prospects, the optimistic predictions of a good season were practically unanimous in spite of the repetition of transportation difficulties during the summer and autumn of 1923 which everyone expects to occur.

The 1923 highway construction program of Missouri was outlined by E. H. Piepmeyer, Chief State Highway Engineer. J. A. Bowman, manager of the Burgner-Bowman Lumber Co., presented his views on the most satisfactory relation between the producer and the retailer of construction materials.

The two-day meeting opened with a report from the treasurer which showed the financial position of the association to be good. Reports of conditions during the past year in various districts followed.

H. E. West, reporting for Oklahoma, told of having trouble getting orders in the spring when cars were plenty, while later, with plenty of orders on the books, it was difficult and often impossible to get the cars needed. At the time of the meeting he was getting plenty of cars.

In the Upper Kaw district business was paralyzed during most of the summer months because of low water conditions, according to O. W. Knight. Then came the car shortage. So for this district, business was not good.

John Prince, in the Lower Kaw district, thought during the spring that someone else was getting the business, so little was there to be had. Then in the latter part of the season there was more business than could be handled. The supply of Kaw river sand is being exhausted and a shortage of supply for Kansas City and surrounding territory from this source is threatened.

Business was not so good in the Missouri river district this year as last year, according to C. H. Fariss, but he expects next year to show a big improvement. R. J. Stewart, from the same district, told how sand from the Missouri river, formerly fine and dirty bar sand, is now pumped and of good quality.

No business during the first half of 1922, fair business during the last half, and prospects of good business in 1923 is the report of N. C. Dunn for the Arkansas river district.

The afternoon was devoted largely to a discussion of the cost of production report compiled by the secretary. A discussion of the Haydite case before the Interstate Commerce Commission also took place during the afternoon. In the evening a theatre party was given to the members and guests by the Kansas City producers.

On Friday morning Mr. Piepmeyer pointed out that Missouri highway specifications had been written to utilize the materials furnished by nature and located within reasonable shipping distances of the work to be done, but told the producers frankly that there was room for improvement in the character of some of the materials they had been producing.

With a total of $30,000,000 to be spent on highway construction and maintenance in Missouri in 1923, prospects for aggregate producers are good and Mr. Piepmeyer suggested that there is a real field of endeavor for them to produce high quality materials.

The highway department plans to cooperate with producers in every way possible. Where the production is sufficient to warrant it an inspector will be kept at each plant, to eliminate rejections at the job. Where shipments are not to be made direct the inspector will pass material for storage at the plant, to be shipped to the job later as required. Contractors will be paid 90 per cent of the value of all materials stored at the job, to help distribute production more evenly over the season.

Extracts from Mr. Bowman's paper appear elsewhere in this issue.

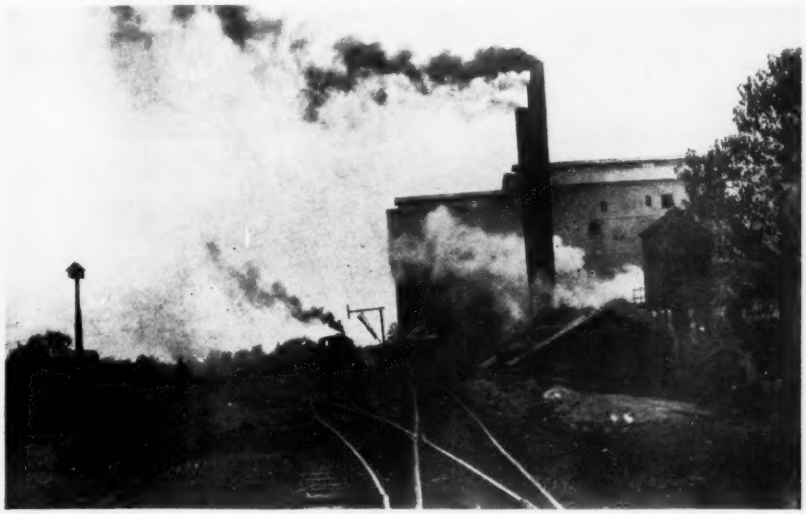
T. R. Barrows, executive secretary of the National Sand and Gravel Association, outlined some of the activities of the National Association, particularly in obtaining cars for members. The effectiveness of this service was testified to by a number of members.

W. E. Johnson, Secretary

Officers for 1923 were elected as follows: President, Harry E. Moore, of Boonville, Mo.; vice-president, Frank W. Peck, of Kansas City, Mo.; treasurer, W. E. Rogers, of Sand Springs, Okla. The following executive committee was elected to represent the districts named: Missouri River, R. J. Stewart; Lower Kaw, C. W. Bartlett; Oklahoma, H. E. West; Upper Kaw, O. W. Knight; Arkansas River, H. A. Schwartz. W. E. Johnson is secretary of the association.

Making One Locomotive Do the Work of Three

AT THE plant of the Indiana and Ohio Stone Co., Greencastle, Ind., a model quarry trackage system has recently been installed that requires the services of but one locomotive to keep the plant supplied with stone.



The locomotive is returning to the quarry with a train of empties after having placed a loaded train on the storage track

In view of the fact that with its former track system the company used three engines to keep the No. 9 crusher supplied at all times, this method is remarkable.

The accompanying drawing and illustration show how the new system functions. The locomotive comes from the quarry with a train of eight loaded cars, passes the plant and switches to a track leading to the crusher. This track serves as a storage for two trains. From this track a train at a time is pulled by cable hoist past the crusher so that the last car is at the dumping point. When all the cars are dumped, the empty train is switched to a side track leading to a track used for the return of empties to the quarry. The track leading from the crusher is laid on a 3½ per cent grade so that an engine is not required to remove the empties.

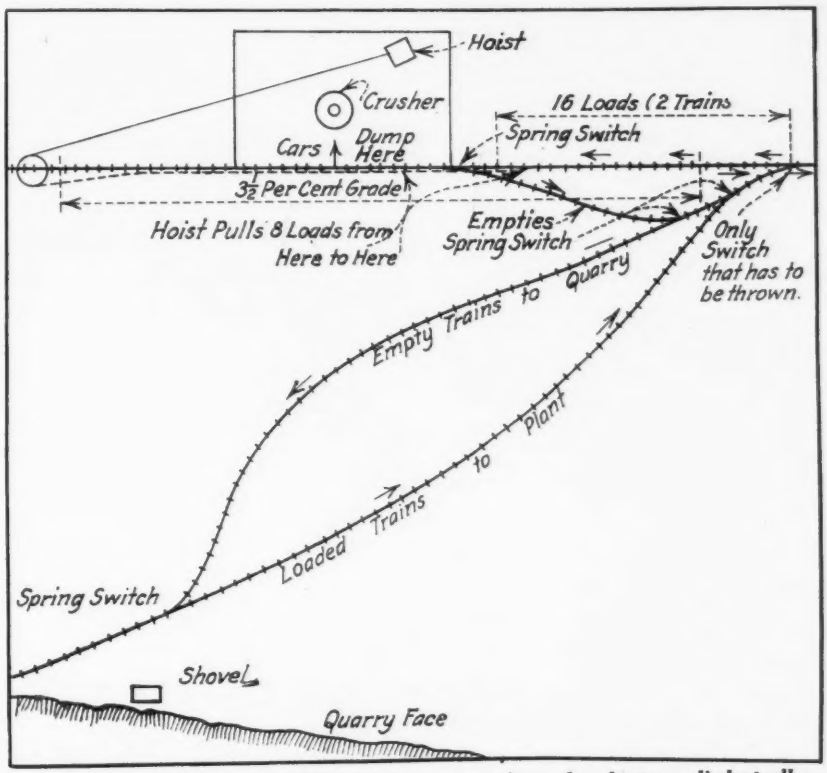
When the locomotive cuts loose from the train it has brought from the quarry, it goes back to the crusher-track switch and then backs into the empty storage track. Here it connects to the train of cars that was being dumped while it was bringing in its last train from the quarry. While the locomotive is returning to the quarry with these empties, the train that was being dumped when the locomotive came in with its last train is dumped and the empties are released and moved to the empty storage track. By the time that train is dumped, the engine has returned to the shovel, had its train loaded, and is on its return to the crusher.

In this way, the storage track at the plant always has an extra train of loaded cars, so that in case of a wreck in the quarry, a breakdown of the shovel, or other delay, the crushing unit is not delayed.

The hoist used to pull the loaded cars from the storage track to the dumping point at the crusher is mounted on the crusher hopper floor and is equipped with two drums. The cable from one of the drums extends to the end of the track passing the crusher. Here it is passed through a 30-in. sheave so that it is in direct line with the cars to be moved. From the other drum a cable extends to the dumping point. This cable is used to dump cars that have been overloaded on the opposite side and which are too heavy to be dumped by man-power. The hoist is operated by the crusher feeder, thus eliminating the services of an extra man at the plant.

With the new trackage system the company has done away with the services of two locomotives and the engineers and has put into service a hoist that had been out of service for some time and which was deteriorating for lack of use. By the installation of spring switches, the services of switch tenders have also been dispensed with. The coal consumption of the operation as a whole has been greatly reduced, as well as the payroll and upkeep costs.

F. E. Weaver, the superintendent, is directly responsible for the installation of the system.

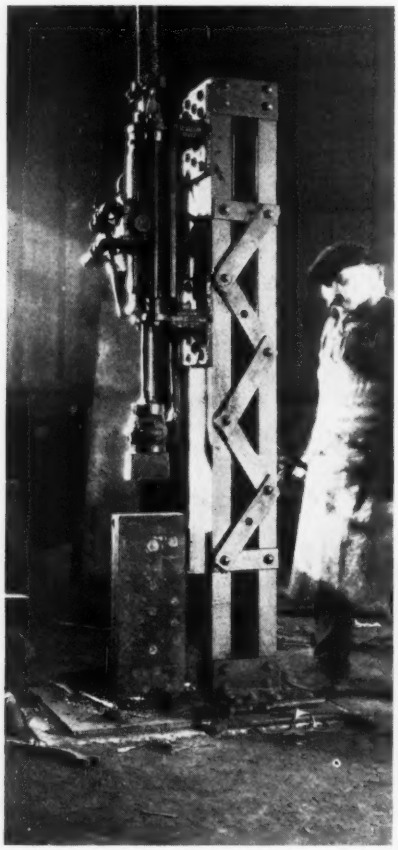


This trackage system enables the company to keep the plant supplied at all times with but one locomotive. Note that there is but one switch that has to be thrown

Hints and Helps for Superintendents

Making a Power Hammer From a Rock Drill

ONE of the most expensive pieces of equipment usually found in a blacksmith shop is a steam or air hammer. For this reason a larger percentage of shops in the rock products industry are not so



This air hammer, made from a discarded tripod rock drill, is capable of handling an 8-in. piece of material

equipped and continue in the old way to use man power and sledges for the heavy work. Power hammers are, nevertheless, essential to every blacksmith shop where work must be turned out in a minimum of time and with a maximum of efficiency.

At the plant of the Birdsboro Stone Co., Birdsboro, Pa., Stanley Rojosky has been employed for the past 10 years as blacksmith. He had always realized the need of a power hammer in the shop and by the time the company had decided to purchase one, he was in the midst of *making* one.

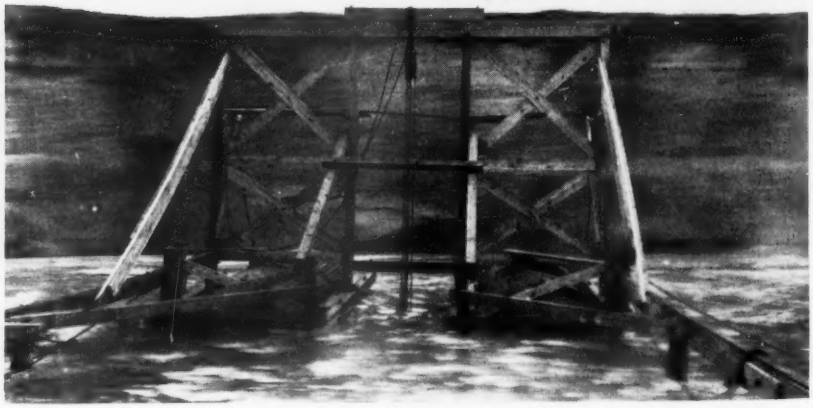
A discarded No. 5 Ingersoll-Rand tripod drill was salvaged from the scrap pile and after several months of experimenting and adding to his original ideas, together with numerous improvements from time to time, Mr. Rojosky finally put into service an improvised air hammer made from the discarded rock drill.

To convert the drill into a hammer it was necessary to change the stroke of the piston from 4 to 18 in. This was done by turning down the piston-rod and welding a piece on the upper end. For a throttle, a discarded hoisting engine valve was substituted so that adequate air pressure can be put into every stroke.

The hammer, as illustrated, was mounted on a structural steel frame erected on a thick concrete base. The anvil block was made of two sections of structural steel riveted together and set on end on the concrete base. This hammer is capable of welding an 8-in. piece of material.

Old Boilers for Pontoons

BOILERS salvaged from a scrap pile are being used as pontoons by the Granite Sand and Gravel Co. of Indianapolis. The pontoons support a structure which in turn supports the suction pipe and agitator of a dredge.



Two boilers serve as pontoons here and support a structure from which the suction and agitator are suspended

Before being put into service as pontoons the boilers were only so much scrap iron, as the tubes were in bad condition and the crown sheets and other parts were rust-eaten. It was a comparatively small task to plug up the boilers to make them watertight.

As shown in the illustration, the pontoons and overhead structure are connected to the dredge on each side by two 2x6-in. timbers bolted together, making the connection doubly strong. The overhead structure is held rigid by wire-rope braces kept at the proper tension by turnbuckles.

Lowering a Quarry Floor by New Method

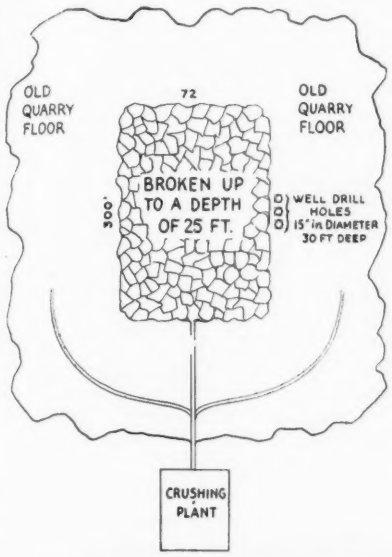
THE engineers in charge of the operating and producing branches of the Consumers Co., Chicago, Ill., have saved their company many thousands of dollars in lowering quarry floor levels by a method they observed in use at one of the France Stone Co. (Toledo) quarries.

The original quarry cut is generally made to about the ground water level. In making a new cut below this level the common method is to blast out a small hole, remove the stone with a clamshell, or some equally laborious method, and then pump the water out. After that a shovel is let down into the hole and it is enlarged to a respectable working face by the usual methods.

By the France Stone Co. method, illustrated herewith, a large area is drilled with blast-hole drills, the same as in opening a new quarry. This entire area is shot with heavy charges at one time, to break it up as much as possible. In this case an area 300x72 ft. was drilled and broken to a depth of about 25 ft.

Then drill holes, made with a special bit, 15 in. in diameter were drilled in the edge of the broken up area to a depth of about

30 ft. These holes of course were driven through broken and shattered rock, and then were lined with old screen plates. Suction intakes were let down into these drill holes and the entire area pumped out. A



A big saving was effected by this method of lowering a quarry floor

steam shovel was then set to work at the edge of the blasted area, and worked right down to the new level, thus saving an immense amount of time and labor.

One Way to Repair Your Belt Conveyor

THE average concentrating mill has in daily use a considerable amount of conveyor belting, writes A. M. Oliver, in *Engineering & Mining Journal-Press.* This belting represents the investment of hundreds and even thousands of dollars and plays an important part in the operating of the mill. Yet it is not unusual to see an expensive belt, several hundred feet long, go out of service prematurely on account of a damaged surface. It often happens that a crowbar or some other heavy tool is dropped on it, tearing a hole in its rubber cover, which is there to protect the belt from abrasive wear. The plies of duck, thus exposed, quickly rot.

There is a way of repairing this damage: If the rubber cover is merely torn back—that is, if all of the cover is there, being only peeled from the body of the belt—the trouble is easily corrected. Wash with gasoline both the cover and the first ply of duck that is exposed. Allow it to dry thoroughly. Do not attempt to do any more until the gasoline is completely evaporated.

Then apply two coats of ordinary rubber cement such as is used on automobile tubes, leaving each coat of cement to dry. When the second coat is perfectly dry, press down the cover of the belt and rub firmly with a file handle or some other dull tool, making sure that no air bubbles remain under the cover.

When the belt cover is completely torn away, it is necessary to replace it. How this is done depends upon the size of the hole. On a small hole, about the size of a silver dollar, wash the damaged part carefully with gasoline, as described. Any tire dealer will sell you a small can of "tire putty," in appearance similar to common putty. Work this putty with your hands until it is the shape of the hole to be repaired, dip in gasoline, and then press it firmly into the hole.

When a larger area of the surface of the cover is damaged, proceed as aforesaid, then cement a piece of an old automobile tube over the exposed duck.

Making a Brush from Wire Rope

IN PLACERING, a wire brush is often needed for rough work like that on boulders and bedrock, and an inexpensive one can be made from wire cable. A piece of ½ or ¾-in. cable, 8 or 10 in. long, makes a fairly good brush. By winding soft wire at the upper end and winding another wire between each strand, the brush will keep its shape, says *Engineering and Mining Journal-Press.*

THE "Hints and Helps" editor wants YOU to send in a description—along with a picture—of any improvised or converted machine that you may have in YOUR plant. Whether it is the product of an original idea or a copied one, other operators will be interested in it. If you haven't a camera, make a rough drawing and send it in.

ROCK PRODUCTS has found that wire brushes can be put to many uses in sand and gravel and crushed stone plants. Brushes of this kind can be used to clean off corrosion, layers of grease, rust and other foreign substances from bearings, pinions, gears and other parts of machinery.

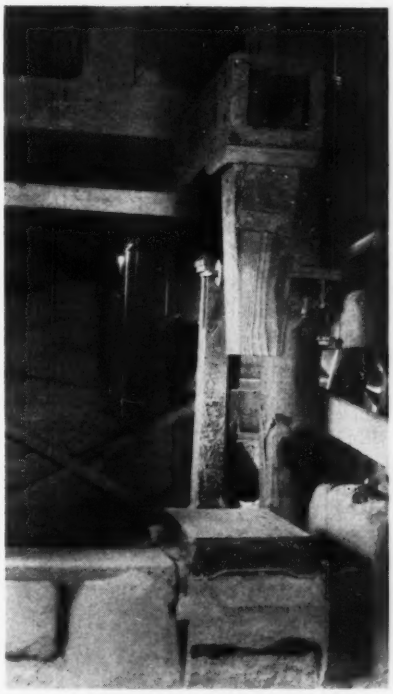
Brush made from wire rope

A brush made from a discarded piece of cable is inexpensive and is easily made. To make the brush easier to handle, ROCK PRODUCTS suggests that it be wrapped with friction tape to prevent the piercing of the operator's hands. As the cost of such a brush is practically nil, every mechanic and machine operator can easily avail himself of one.

A Homemade Packer

A SIMPLE contrivance for removing agricultural limestone from a storage bin and discharging it in bags, is in use at the Lehigh Pulverized Limestone Co.'s plant at Allentown, Pa.

Directly under the storage bin are two friction cones, one of which is mounted on a shaft driven by an electric motor. The other cone is mounted on a jackshaft and is controlled by a foot-lever clutch. This shaft makes a direct connection with a 6-in. x 7-ft. double-flight screw conveyor enclosed in a leak-proof wooden box which discharges into a packing spout.



This home-made screw conveyor packer can fill 115 bags per hour. Note the foot lever to the right of the platform scale

The foot lever controlling the clutch extends to within reach of the operator. The material is fed to the conveyor from the storage bin by gravity so that the action of the foot lever engaging the cones causes the conveyor to operate, thus discharging a steady flow of material into the packing spout.

The company states that this equipment is capable of packing 115 bags, or 5¾ tons, of agricultural limestone per hour.

The Rock Products Industry in 1922

A prosperous year for all but a few branches of the industry—A year of marked achievement for all

THOSE rock-products industries which depend largely on construction activities for an outlet, with a few exceptions, had a more than ordinarily prosperous year in 1922 in spite of all the various handicaps. Of course, construction activity was not uniform throughout the country. There was more building in the Northeastern states than elsewhere; and in the Northwest and Central West agricultural states there was actually less than a normal amount of building. However, in these states highway work was generally active; so that altogether, 1922 will go down in history as a very active period for the construction industry and its subsidiaries.

Cement

The cement industry had the biggest year in history. The production will probably total 120,000,000 bbl. The plants in the Central and Far West states seem to have produced a larger percentage over 1921, 1920 and 1919 production than the Eastern plants. Yet with even this immense production, few of the present plants produced 100 per cent of their capacities. The trouble with the cement industry is an excessive demand at times and inability to store a sufficient amount to take care of peak loads; and very likely inability of the railways to handle shipments to meet peak demands upon existing plants.

The president of one of the largest cement companies—operating plants in many parts of the United States—writes: "Our business, of course, has been larger this year than has ever been known and every indication would seem to assure a continuance of the demand. The cement industry, however, has been so greatly over-built that it is almost impossible to conceive of a demand which the present productive capacity cannot take care of. If some means could be found to persuade large contractors and others to take delivery of a part of their annual requirements during the first three months of the year, there would be no question but that the present capacity would be in excess of any demand for 1923. There are, however, three or four conditions confronting us which may very easily change the situation.

"The most important of these conditions is the possibility or strong probability of a strike or suspension of work in the coal fields. Whether this suspension will be of short or long duration no one can foretell, but it seems to me that all dealers in Portland cement should see that their warehouses are filled by the first of April, and that manufacturers should reach that period of the year with storage warehouses full, so as to, as far as possible, take care of the demand for cement should it be impossible to procure coal.

"Another doubtful element is the supply of labor. The present immigration law has cut off the supply of common labor which has been largely used in the cement industry for many years past. It is true that up-to-date factories have, during the past six or eight years, installed a great deal of labor-saving machinery. It is still necessary, however, to employ large quantities of so-called common laborers by the cement plants and this same type of labor is largely used in construction work; so that, both from the viewpoint of the manufacturer and the contractor, the possible shortage of labor is a serious matter.

"Generally speaking, we look for a better car supply than we had last year. At the same time there is an element of doubt here. I have no comments to make as to prices, other than to say that with the present price of coal and rate of pay for workmen, the prices now being asked are low, taking into consideration the difficulties confronting the manufacturer in the coming year."

Lime

The most notable achievement in the lime industry during 1922 was the decision of lime manufacturers, as represented by the National Lime Association, to "take the bull by the horns" and wrestle with the problem of restoring lime in the good graces of the construction industry. Admirable progress has been made in extending the use of lime in the chemical industries, but in the construction industry lime has been slipping for some time past. Only the Ohio hydrates seem to hold their own and increase the demand for lime in construction. Apparently few lime plants produced more than 50 per cent of their capacity in 1922. The prospects for 1923, with an aggressive management of the National Lime Association are vastly better.

Gypsum

As a whole, the gypsum industry probably profited more by the extraordinary building activity in 1922 than any one of the other rock products industries. Great progress was made in standardizing gypsum products and in extending gypsum into new fields. Many labor-saving devices have been introduced, especially in the manufacture of wall-board. One large manufacturer has just about tripled the output of wall board per man per day.

Crushed Stone

The most notable achievements in the crushed-stone quarry industry have been the steps taken to eliminate all possible hand labor. This has meant changing over more and more quarries to well-drill and shovel operations; the wider use of the caterpillar traction even on large shovels; the use of more motive power in quarry transportation systems; the installation of larger crushers and improved screening plants.

A much larger number of quarries and crushing plants are operating this winter than ever before. This is probably due to a continued demand on account of the mild winter weather, and because the prospect of a labor shortage makes it improbable that there will be any reduction in the cost of production another year. This winter it would seem, justifies stocking up against next spring's demands.

Few quarries and crushing plants, apparently, operated to more than 75 per cent capacity, and many to not more than 50 per cent, chiefly on account of the car shortage. The changes and improvements in quarry operation are therefore favored by conditions of labor shortage rather than for reasons of increased production. The prospects for 1923 are very good indeed.

Sand and Gravel

The increased production of Portland cement is reflected somewhat in the sand and gravel industry. Most plants in the East and Central West had the best year since the war. Nevertheless car shortage and railway troubles prevented their producing any where near their possible capacity. The South was the hardest hit by the transportation shortage.

It is obvious that the commercial sand and gravel industry today is not producing 50 per cent more material than it did before the production of portland cement increased 50 per cent. The high freight rates and car shortage are diverting much of the natural increase in production to small local sources of supply.

Theoretically, on a 1:4 mix basis, 96,000,000 tons of sand and gravel would be required for the aggregate to use with 120,000,000 bbl. of cement. From any available statistics not over half this amount of "commercial" sand and gravel is sold for concrete aggregates.

Silica Sand

There was no outstanding feature of the

silica sand industry in 1922. The foundry sand business was fair, but suffered much from the transportation situation. The glass industry demand was fair but suffered some from foreign competition. Few silica plants produced more than a portion of their possible capacity.

Phosphate Rock

There was a fair demand for Florida rock and pebble for export, but the Tennessee section suffered from the general stagnation of the farm-supply business. Prospects for next year are very much better.

Slag

Eastern slag plants did a good business. Southern plants were badly handicapped by car shortage. Eastern plants did a fine business in truck hauls.

Talc and Soapstone

The past year was a fair one with the talc and soapstone industry. There were no outstanding developments. Next year offers about the same prospects.

Sand-Lime Brick

The sand-lime brick industry got its share of the general prosperity in the building field in 1922. The manufacturers are bending every effort to improve and standardize their product, and its merits are becoming better known to architects and engineers every year.

Slate

Producers of slate roofing granules enjoyed a good demand for their product, which bids fair to be maintained for some years to come, as this form of roofing is growing rapidly in popularity. Roofing slate and structural slate seem to be just about holding their own in the face of constantly increasing competition. Shortage and high cost of quarry labor is also getting to be a serious matter with slate quarry men.

Agricultural Limestone

After a year or two of quiet, the agricultural limestone business appears to be coming back strong. Next year bids fair to be the best in history.

The Portland Cement Industry in 1922

Move to Enlist Public Goodwill; to Do More Research Work on Nature and Quality of Cement; New Plants Under Construction

THE work and progress of the portland cement industry as typified by the Portland Cement Associaton was reviewed at length in the December 2 issue of ROCK PRODUCTS. Some points not brought out there will be briefly touched on here.

One of the most important steps taken by the industry in 1922 was the determination to enlarge the laboratory research program to include study and investigation of the constitution of portland cement. Little attention has been paid to this matter by the association in the past. Most of such research work in the past has been done by private investigators, the U. S. Bureau of Standards, and the Carnegie Foundation.

The tendency in the past has been to make a standard product of uniform quality. It has been shown that there are possibilities of making a better product and now the portland cement industry intends to investigate these possibilities for itself.

Interest in Quarry Labor-Saving

Portland cement manufacturers are taking renewed interest in the quarry end of the business. Labor shortage is getting to be a very serious problem and many companies have gone, or are now going, the limit in the way of mechanical equipment for quarry operation.

In this connection portland cement manufacturers can get many pointers from crushed-stone quarry operators who have been trying to eliminate hand labor for a number of years. There are possibilities of forming an American Quarry Institute, the principal object of which will be to study comprehensively and exhaustively ways and means of reducing quarry costs and of operating quarries with a minimum of labor.

New Plants Under Way

The year 1922 was an active one for new projects in the portland cement industry. The plant of the Pyramid Portland Cement Co., at Valley Junction, Ia., of 3000 bbl. daily capacity, was practically completed. A new plant for the Sandusky Cement Co. is nearing completion at Toledo. The plant of the Signal Mountain Portland Cement Co., near Chattanooga, is practically ready for operation.

Other plants in the progress of construction include two at Birmingham, Ala., for the Lehigh and Phoenix Portland Cement companies, respectively; a plant for the Western States Portland Cement Co., near Davenport, Ia.; a plant at Mt. Pleasant, Mich., for the National Portland Cement Co.

Projected plants include one for the state of South Dakota at Rapid City, S. D.; one for the Hermitage Portland Cement Co., at Nashville, Tenn.; one for the Pittsburgh Plate Glass Co., at Zanesville, Ohio, and two for the Southwestern Portland Cement Co., at Waco, Tex., and Phoenix, Ariz., respectively. The Linwood Cement Co., of Davenport, Ia., has announced its intention of proceeding at once with the construction of a long contemplated cement plant near Davenport, Ia.

Many old-established companies have completely rebuilt their plants. The description of the plant of the Cape Girardeau Portland Cement Co., elsewhere in this issue, is a good example of the progress in this line. Probably within the next two years all cement plants older than 10 or 12 years will require extensive alterations, additions, and improvements to bring them to a competitive operating basis with the new plants. If all the old plants keep in operation, the possible production of cement in a year or two will be in the neighborhood of 150,000,000 bbl.—if a market can be found for it all.

New Cement Plant for Arizona

THE Southwestern Portland Cement Co. of El Paso, Tex., and Los Angeles, Calif., is considering the erection of a cement plant near Phoenix, Ariz. This announcement was recently made by O. J. Binford, secretary and general manager of the company. Mr. Binford stated that the plant will cost approximately $1,250,000.

This company now owns and operates two plants, one at El Paso, Tex., another at Victorville, Calif. The El Paso plant, having a daily output of 2800 bbl., is a dry-process plant using coal. The Victorville plant, with an output of 2200 bbl., manufactures by the wet process, using fuel oil. It is furnished by hydroelectric power.

No announcement has been made as to the type of the new plant at Phoenix.

Wisconsin's Outlook for 1923

Construction work scheduled for 1923 in Wisconsin will require an increase of 20 per cent over 1922 in the production of aggregates. Wisconsin producers were therefore rightly optimistic at their recent annual meeting, an account of which is given here

GOOD business in 1922, with the prospect of still better business in 1923, is the essence of the reports of aggregate producers of Wisconsin at the annual meeting held in Milwaukee on December 21. That the Wisconsin Mineral Aggregate Association as an organization is in excellent condition was brought out by the treasurer's report showing a goodly surplus—approximately the same as last year's balance—on hand. This balance remains in spite of a decrease in the assessment for 1922 of a quarter of a cent per ton from the preceding year's assessment, which was 1 cent per ton.

The association meeting was held in the afternoon at the Hotel Pfister, with a banquet and entertainment with more than 100 members and guests present at the same place in the evening.

The work of the Good Roads Association of Wisconsin was commended and the association voted to further its support.

Bigger Output This Year

In his review of the past year N. K. Wilson, executive secretary of the association, referred particularly to the car shortage and its effect on Wisconsin aggregate producers. The shortage was serious and without question greatly lowered the 1922 output required to complete the construction projected for the year, but in spite of this condition the final shipment figures for the year will probably show an increase over 1921 of 150,000 tons. A large measure of this excellent showing can be attributed to the work of the association officers, and that carried on at the central office of the association, in the procurement of cars. The association was in constant touch with officials of all railroads, and a representative of the association who visited various mines and car distributing points of the railroads aided in preventing a possible congestion of cars at main distributing centers.

As a result of the car shortage and the accompanying lack of materials on the job, a considerable portion of the Wisconsin highway program could not be completed. About 125 miles of concrete road work has been held over, and together with the 400 miles of new concrete highway and more than 1,000,000 yards of city pavement planned for 1923, prospects for a good season next year are far better than for many years.

The shipping season in Wisconsin for aggregates is particularly short, but this handicap is going to be partly overcome next year as a result of a recent ruling of the State Highway Commission, which requires on jobs where aggregate is to be shipped by rail and where entirely feasible, that a certain portion of the material, likely to be about one-third, must be on the job before work is started. This will result in storing on the job 250,000 to 300,000 tons of aggregate during the early months, and will give the producer an effective shipping season several weeks longer than usual. Records for past years show that 51 per cent of aggregate shipments in Wisconsin have been made in the three months of June, July and August.

J. K. Jensen, re-elected president of the Wisconsin association

Early Lettings for Highway Contracts

Another step which will aid the highway construction program and the aggregate producers alike is the efforts of the highway commission to obtain early letting of contracts. January lettings are being urged; and this, together with the provision for storage, will mean more early shipments and a longer season, with greater total shipments.

A calendar map showing the location of all pits and quarries of the member companies, with a list of these companies, has been prepared and will be distributed to contractors and other users of sand, gravel and stone. The association plans to establish a highway service bureau, where all information pertaining to work under contract and work advertised will be collected and sent out to members who can thus keep individual files with a complete record of the entire 1923 highway program.

With estimated shipments of 2,000,000 tons of aggregate for 1923 by its members in the state of Wisconsin—an increase of nearly 20 per cent over 1922—members of the association are rightly optimistic.

Opposed to Priorities

The former officers of the association were re-elected, as follows: J. K. Jensen, president; J. D. Ohrt, vice-president; I. M. Clicquennoi, secretary-treasurer. The executive secretary is N. K. Wilson. The association authorized the secretary to draw up and present to all interested parties resolutions showing the association to be heartily opposed to priority orders and to the principle which invests any individual or body with the power to issue such orders.

Mr. Sloan brought to the attention of the association several bills to be presented to the coming session of the legislature.

A guest of the association was A. P. Sandles, secretary of the National Crushed Stone Association, who spoke to the meeting briefly on association work and the value of publicity, and who at the evening banquet delivered an address that won the favor of ladies and gentlemen alike.

The evening was made gay by suitable entertainment between the dinner courses and following the dinner. Vocal solos and duets and special dances by entertainers, together with a duet by Mr. and Mrs. H. M. Halvorsen and readings by E. G. Brown, made the evening pleasant. Both Mr. Halvorsen and Mr. Brown are members of the association.

An address by Hon. Henry R. Rathbone, congressman-elect from Illinois, on a world ideal, followed by community singing, led by Miss Lois James, completed the evening's program.

The Design of Sand Plants

By Edmund Shaw
Consulting Engineer, Chicago

No. 2—This installment describes simple forms of dry-land sand plants and begins the discussion of settling boxes and how to calculate them to settle only the size of sand that is wanted

IN the first of this series, published in ROCK PRODUCTS for December 16, sand plants dredging sand from rivers were described and some improvements on the ordinary type of plant were illustrated. Reasons were given for the satisfactory work of the cruder form of plant, which has only to deal with sand already washed and classified by the river, and it was shown how an improved form became necessary as the supply of this preferred material became exhausted.

Dry land plants, producing only sand and not sand and gravel, are not so commonly found as the dredging plants described in the last issue. Operations are commonly on a small scale and usually only for delivery by truck. They are often to be found on the outskirts of cities and towns, in the radius of truck delivery, and where the betterment of the land and its adaption to building purposes is of as much consequence as the marketing of the sand.

As a usual thing, these dry sand plants do not differ much from the regulation sand and gravel plant, and the same methods of excavating the crude material are used in one as in the other. But the straight sand plant is simpler and the head room may be less, as no system of screens for producing sized products is required. Advantage may be taken of the low head room to simplify the entire operation.

Fig. 8 shows a section through a sand plant in which this has been done; a comparatively small operation near a large Eastern city. The sand is mined by a scraper bucket of a common type, especially adapted to small operations and very useful where mining is not carried much below the water level. The usual way to operate with such a scraper is to draw the excavated material to a hopper. This hopper is set over the end of a belt conveyor which conveys the sand to the plant. But in this plant the conveyor is omitted.

To get the necessary elevation, the scraper is drawn up an incline covered with rails, and the load is dumped into an elevated hopper. This would not be advisable if there was much of an elevation. The load is deposited on a flat grizzly, which takes out the few large stones that are encountered. As there are not enough of these to pay for crushing and handling, they are merely rolled to one side and afterward used for repairing roads about the plant.

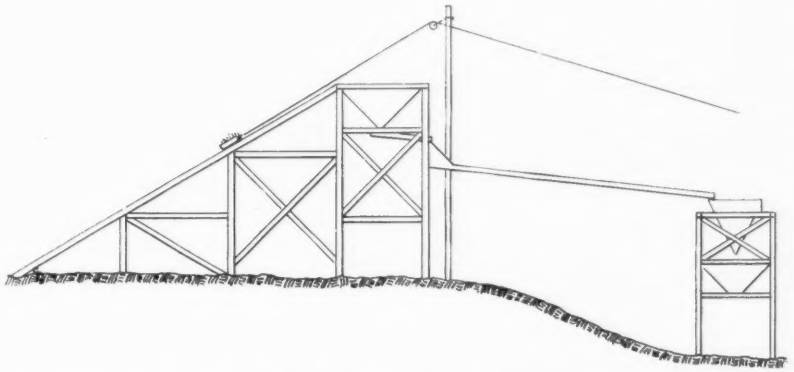


Fig. 8—The straight sand plant may sometimes be designed so that the entire operation is simplified

The sand, with a little oversize, falls into the hopper through the bottom of which a stream of water flows. The water takes the sand through a sluice to a stationary screen, which takes out the oversize. After passing the screen the sand and water go to an automatic settling tank, which serves to wash and dewater the sand. The tank is set to discharge into a small hopper from which the trucks are loaded. No storage is provided, and the hopper is placed there only to prevent the sand from falling on the ground while the trucks are being changed.

Mining Sand With a Stream of Water

Another design is an application of hydraulic mining on a small scale. Hydraulicking is permitted in this case because there is a very high bank to be mined which gives plenty of head to flow away the material as fast as it is excavated. The operation is exceedingly simple. The water is given the necessary pressure by the use of a centrifugal pump adapted to pumping against a high head, which is a very efficient and satisfactory machine for this sort of work. The sand is carried by the same water that excavates it through a sluice to a gravity screen and to an automatic settling tank, set as in the design previously described.

There is no need of a grizzly as the inclination of the sluice will not let the water carry any large stones. These large stones are picked up and thrown aside as they are encountered, and there are not enough of them to interfere seriously with the work.

Special conditions make this work most profitable. Ordinarily it would not pay to work the upper part of the bank and leave the lower part, but this is one of the cases where the improvement of the land is of the first importance and the sand operation is only secondary. The fact that the land is improved for building sites at no cost, but with a profit from the sale of sand, makes it an especially profitable operation.

The equipment cost of such a plant is low, being almost wholly confined to the cost of the pump and motor, the settling tank and a little piping.

Settling the Main Point of Design

Plants which employ dry methods of digging have one advantage when it comes to washing and settling the sand: the amount of water that is used for washing is kept constant. In the dredging plants which were described in the last issue, it was shown that the amount of water and solids to be handled by the settler varied constantly, which made uniform work impossible. But with the dry digging plant the amount of water is constant, since it is the whole flow of a pump discharging only water, and the amount of solids may be kept constant, provided a little care is taken to design the arrangements for feeding them correctly.

Settling is, of course, the main point of any sand-plant design. There is no screen-

ing beyond that of passing the feed through a screen of limiting size, and there is rarely any difficulty with the removal of clay. Once in a while one finds a deposit which contains the most difficult form of clay, clay balls, but these are in great part removed by the screen and those which are left may be taken out by the settling tank if it is designed for the work. This point will be taken up in a later installment.

So the efficiency of a washing plant dealing with sand only may be said to be that of the settling box, or tank, or whatever device is used to retain the sand.

In order to illustrate the principles of settling-box design, different forms will be described, as it will be seen that the form, or shape, as well as the area, affects the work. Long, narrow boxes are poor settlers, for the sand is carried along in them as in a trough. Short, wide boxes are the best settlers, but they are inconvenient to feed. Square boxes are between the two.

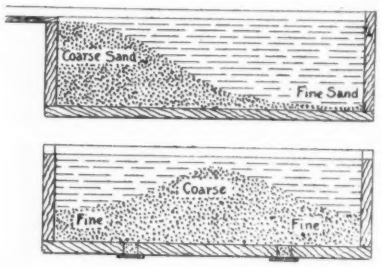


Fig. 9—A long box fed at the end is a poor settler. The same box fed in the center will deliver a fairly uniform product if the gates are properly placed

Size is the most important thing in a settler. If the settler is made big enough it will settle everything, so that the same mixture of mud and sand which was fed to it will be taken out when the settler is emptied. The settler must be big enough to settle what is wanted, but not so big as to settle what is not wanted. Usually, we want to take out some fine sand as well as mud and clay. There are exceptions to this rule for some deposits are actually deficient in fine sand, but these are the exception.

In most cases we want to take out as much as we can of the sand finer than 100 mesh, and the calculations to be made will assume that this is to be done.

The Plain Rectangular Settling Box

The plain rectangular settling box is the commonest form, and the feed is usually admitted at one end and discharged at the other. This can never be made to do very good work.

A good settling device will give a uniform product and will settle the same sizes all the time that it is in use. This long box settles coarse sand at one end and fine sand at the other, so the product is not uniform. If settling is carried on after the coarse sand has filled one end, coarse sand will be settled farther and farther along until the box is full, but there will not be a uniform mixture; there will be layers of different sizes.

The sketch, Fig. 9, shows this, and it also shows how settling may be improved by putting the feed into the center of the box instead of at one end. This practically makes two square tanks of one long tank. The product will not be quite uniform, but by arranging the gates to draw off the sand at the right points, a fairly uniform product will be delivered at each gate.

The wider the current that flows through the box the slower it will flow, and the finer the sand that will settle. The whole theory of designing settlers is in this sentence.

In theory, the depth of the current passing across the settler has no influence on the settling. This can be proven mathematically. (Volume of feed equals the width of the current times the depth of the current, times the length of the tank, times the falling rate of the grain, divided by the depth of the current. Since we multiply and divide by the depth of the current, it cancels out and does not appear in the final result.)

For illustration, we will take a tank 24 ft. long and 12 ft. deep, which is a common size. We want to make the width such that it will settle all the sand coarser than 100 mesh.

Fortunately, it is the width of the current and not the actual width of the tank that concerns us. We can put partitions (extending about a foot below water) in the tank which will confine the current to the width we want. And this has been done in the sketch, Fig. 10.

We will admit the feed in the center, since that gives a more uniform product, and will run the overflow toward the ends. We will take a space 4 ft. wide for the feed, and this will leave us 10 ft. on either side through which the current must pass. Now a grain of 100-mesh size falls about 0.7 in. in a second in water. If we assume that it will be carried out of the tank unless it falls a foot, it is plain that it must not be longer than 17 seconds in the current, if it is to be thrown out with the overflow.

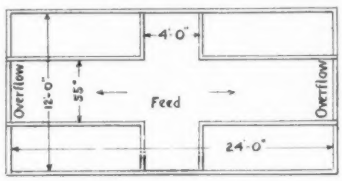


Fig. 10—Partitions extending a little below the water will confine the current in a too large settling tank so as to overflow the clay and fine sand

Ten feet divided by 17 gives us 0.59 ft. a second as the velocity we want.

The volume of flow equals the area through which the flow passes times the velocity. We will take the volume at 1 cu ft. and we know the velocity is 0.59 ft. per second. The area then is 1.7 cu. ft., and if we assume a depth of 1 ft., the width will be 1.7 ft., or a little over 20 in. for each cubic foot per second that is fed.

Suppose that we had a feed of 2,500 g.p.m. to deal with. This is 1,250 g.p.m. to each end, which is about 2.76 cu. ft. per second. We will therefore set our partitions 20 times 2.76 in. apart, or say 55 in., as shown in Fig. 10.

Such calculations are only approximate, and in putting in partitions arrangements must be made to vary them so as to make the space a little wider or narrower. By shifting them a little at a time the place can be found which will give the size of sand that is desired in the settled product, provided the water flow is constant.

(To be continued)

Indiana Crushed Stone Association's Annual Meeting

AT the December meeting of the executive committee of the Indiana Crushed Stone Association, held at the offices of the association in Indianapolis, it was decided to hold the annual meeting at Chicago during the National Crushed Stone convention at the La Salle hotel, on January 15, 16 and 17.

The members present reported a good year for 1922 and the majority of the commercial quarries at this time are running full force. This is an exception for December, due to practically two reasons; the increased demand for crushed limestone and weather conditions.

State and county officials are becoming more exacting as to quality and preparation of road materials used in construction and maintenance, and the commercial quarries report that the year 1922 will go down in history as the biggest year in the history of the crushed limestone industry in Indiana. The members were enthusiastic over the prospects for the coming year.

Several of the operators, contemplating an increased demand for 1923, are investing in additional equipment so as to take care of the demand, as well as to be able to produce necessary sizes suitable for all types of road construction.

New Crushing Plant for New Jersey

THE Lime and Stone Products Co., of Hamburg, N. J., has put its new crushing plant into operation. The plant which is electrically equipped, is said to be the largest in that section and is furnished stone from a quarry having a high grade of limestone. The company has a market for entire output, and reports that the scarcity of labor is all that will prevent running at full capacity all winter.

Penn Sand and Gravel Co. to Double Capacity

THE Penn Sand and Gravel Co., Tullytown, Pa., is remodeling its No. 1 plant to increase the present capacity of 1250 tons per day to 2500 tons. All equipment necessary to make the increase has been ordered. The preliminary excavations have been made and the razing of old buildings completed.

The company has purchased several hundred acres and now owns approximately 1200 acres of sand and gravel property. The material averages from 60 to 75 per cent gravel. Several hundred acres are to be converted from an open pit to a pond operation. The former digging equipment, comprising a 3-yd. dragline excavator, 4-yd. dump cars and locomotives, will be taken out of service and will be replaced by a 34x 90x8-ft. dredge equipped with a 3-yd. orange peel bucket and three 300-ton capacity barges.

The unloading unit has been completed and the necessary equipment installed. This includes a wharf 225 ft. long constructed of steel sheet piling, an unloading derrick equipped with a 2-yd. clamshell bucket, a three-drum 12x12-in. Lidgerwood steam hoist, a 7¼x10-in. Lidgerwood swinging engine and one 150-hp. Erie boiler. The derrick machinery is housed in a building of structural iron and glass so that the operator can see the movements of the boom and bucket when it is in any position.

A hopper to receive the material from the unloading derrick will be constructed which will be approximately 25 ft. higher than the foot of the derrick. This hopper will be equipped with a steel-bar grizzly, which will be inclined to the initial crusher. Oversize from the hopper will be moved by gravity to a storage pile.

The crushing and screening plant will not be changed to any great extent. Two No. 36 Chalmers & Williams disc crushers are to be replaced with two No. 48 crushers of the same type.

J. C. Mundy of the company's Philadelphia office is in charge of the reconstruction and the installation of new equipment, and expects to have the new operation functioning by March 1.

Palmer Co. Will Enlarge Its Plant

DURING the coming winter months the Palmer Lime and Cement Co., of York, Pa., will make several changes and additions in its lime manufacturing equipment. The company has already laid the foundations for several new buildings and all dispensable buildings have been torn down, preparatory to the installing of new machinery and erecting new buildings.

The new equipment includes a Ruggles-Coles drier, a Schaeffer hydrator and Link-Belt conveying and elevating machinery. These buildings will be of steel and glass construction and modern in every respect.

This company has in use 12 kilns, 10 of which are 11x50 ft., of Keystone manufacture. The other two kilns are Schmatolas 33 ft. in diameter and 100 ft. in height. These kilns are said to be the largest shaft-kilns in use in this country, having a daily capacity of 75 tons each. The output of these kilns, together with that of the 10 smaller ones, makes it necessary for the company to enlarge its plant in order that the product can be more economically produced.

The kilns are supplied with stone from three quarries, two of which are being worked on three levels. In each of the two quarries the operation is going down 50 ft., and from this level stone is obtained of the highest quality for lime making. It is estimated that the owned and leased properties contain 15,000,000 tons of stone. Recent tests have shown that the stone is of the proper analysis for lime making to a depth of 150 ft. below the present quarry floors.

The reconstruction and installation of new equipment will be supervised by C. G. King, general manager and superintendent. Mr. King expects to have the new machinery in operation about April 1.

All the derrick machinery is contained in the glass house in the foreground. The 225-ft. wharf is constructed of steel sheet piling

Mineral Products Co. to Rebuild

ANNOUNCEMENT has been made by officials of the Mineral Products Co., of New Castle, Pa., that work will be started at once on the rebuilding of its plant at Harbor Bridge, Pa., which was destroyed by fire in September.

This company deals extensively in washed sand and gravel. At the time its old plant was burned the company had a lease on 25 acres of sand and gravel property located on the Green farm. This lease has been extended to include the entire farm of 120 acres—enough to justify the erection of a modern and complete plant. The estimated cost of the new plant is $50,000 and it is expected that it will be in operation on or before April 1, according to President David H. Kay. All those interested in the company are business men of New Castle.

New Lime Plant for Alabama

A NEW lime plant of 3000-bbl. daily capacity is to be built by the O'Neals Lime Works, Inc., at Vernon, Ala. Vernon is near Calera and about 40 miles south of Birmingham. This company has just recently been organized with a capital stock of $1,000,000, with John H. Adams its president.

Surveys have been completed and the actual construction will be started immediately. The Louisville and Nashville Railroad Co. has made the necessary surveys and the work of laying a 1½-mile siding from Calera to the new plant will be started at once.

The unit will consist primarily of 10 kilns and all equipment procurable in Alabama will be purchased there. Completion of the plant depends upon the promptness with which the company can secure material and equipment, and it is hoped to have the new operation functioning in the early summer of next year.

Mr. Adams has recently returned from an extended trip through various sections of the United States. On this trip he inspected several of the largest plants, gaining information and obtaining data which the company will use to advantage in building this plant.

Quarried from Life

By Liman Sandrock

A Happy New Year to You!

1923! It's a lusty, crowing kid on its very first day—one of those Leyendecker tykes, sturdy on its little pins and full to the brim of the joy of living.

This year, just ushered into being, will mean much to us of the rock products industry even before many of its days are things of the past.

First, let us make of it a Happy New Year—it's our heartfelt wish to you, one and all!

Down deep in the hearts of us there has been awakened by this festal season the urge to make our loved ones aware that ours is the desire to make them happy.

The ringing in our bosoms is sounding the glad tidings to our own little world and to yours that all is peace on earth to men of good-will.

It's the season that brings to us fine thoughts, generous actions, and the wish that happiness has found its way to all of us.

In the past few days have come to ROCK PRODUCTS many, many messages of kindliness and good will for the coming year. And we are deeply grateful!

Our only regret is that we cannot mention by name all those who have found place for us in their memory in the midst of their own immediate surroundings.

We therefore hold out to you the hand of brotherly regard and wish you all the pleasure and prosperity that should be yours in the coming year—and then some!

This season is breathing the very essence of fraternity and good will, and long before you will have reached this little "quarry," you will doubtless have been deeply impressed by the great optimism and faith that are predicted for the year before you, as inspired by the pages contributed to this issue of ROCK PRODUCTS by our leaders in the industry.

You must be main proud of your calling—of its wonderful progress; the many plans made for its advancement and success; the untiring devotion shown and sacrifices made by those who have unselfishly devoted their time and money and thus builded for the good of our order.

Hence, let us join hands with Tiny Tim and say—

"God bless us, every one!"

They Said It

COMMISSIONER POTEET has sold 1700 cement bags, at 10 cents each, to a local contractor, thus netting the city $170.
Port Arthur, Texas, News.

Down in Port Arthur lives Mr. Poteet,
Who's saved that good city one-seventy neat
By selling cement bags at 10 cents per each—
Oh, Mr. Poteet, your example's a peach!

"DO YOU KNOW all there is to know about tetranitromethylaniline?" asks the United States Bureau of Mines. We refuse a challenge of this sort. It's beneath our dignity to answer. Besides, why pick on us?

THE *Lit'ry Digest* asks this burning question: "Is 1923 to be a 'hell-raiser' year?" To us it looks as if the proletariat hadn't waited for January 1, the hoi-polloi was closely following suit, and the regular fella was holding off until the calendar date.

JOHN R. MORRON, president of the Atlas Portland Cement Co., in a glowing panegyric upon the benefits cement has conferred upon the progress of this generation, declared that "cement has cut in two the maritime distance between coast and coast, and built the very foundation upon which rests our Goddess of Liberty, who beckons and guides the oppressed of other nations to our shore!"

WATCH Wesley's Smoke! The Alton *Democrat* announces to the well-known world that townsman J. Wesley Harmon "left Monday morning for Valley Junction, Iowa, where he has a position with a big cement plant. The position is clerical and is said to be good pay."

"THIRTY TO EIGHTY MILES an hour is a common speed for birds," declares a government bulletin. This is a fine example for some of those birds at the Chicago elevated stations who keep us in line until all the seats are filled.

COLLEGE PROFS, give heed! *Engineering & Mining Journal Press* says: "We have only one preliminary suggestion to make to college authorities: The inculcation of a sense of intellectual humility among those of immature experience—an appreciation of the fact that the real education of the graduate begins when he leaves college."

A NATIONALLY KNOWN advertiser, in exploiting its wares, says: "Ask your mules, they know!"—a variation of "Your nose knows." Many's the query put to the average mule wherein the snappy comeback is a swift kick. These mules must have an ear to the ground.

"BOOTLEGGERS' COAL" is what a producer calls the fuel now holding up the much needed equipment. It's well named—it has a kick in it; has put the coal operator to sleep, and we're about crazy from the effects.

OHIO'S "BIG STICKER" is the sticker its soils department is distributing—25,000 of 'em!—to be pasted on the phone, correspondence, the auto, and even the barn door, as a step to popularize the "Ohio Standard Dozen" fertilizer analyses. They will, it is said, make the farmer get more for his money, with less freight to pay, and less weight to handle. You may remember the boy who got the job because he was the only one who could "make it stick."

Spicy, If Not Caustic

ONE of our readers, possessed of a lively wit, tells us that he nearly guffawed the top off his stockpile when he read the following, credited to the *American Mutual Magazine*:

Man (in drug store)—I want some consecrated lye.

Druggist—You mean concentrated lye.

Man—It does nutmeg any difference. That's what I camphor. What's it sulphur?

Druggist—Fifteen scents. I never cinnamon with so much wit.

Man—Well, I should myrhh myrhh. Yet I ammonia a novice at it.

Editorial Comment

Association Exchequers

One of the most interesting subjects before the annual meetings of trade associations, which come about this time of year, is the condition of the exchequer. Most trade associations struggle along always seeking more money for new activities, but always in arrears for past performances. Every association goes through this stage of progress. It is hard to get and keep members without activity; it is hard to be active without funds. Consequently, it is well to have a definite idea of what are profitable activities.

Such activities should not be a subject for convention debate. They should be determined in advance by the best minds in the association. Once decided upon, they should be adhered to with the strictest attention. Deviation from them, unless fully justifiable, will surely lead to trouble and dissension. The yardstick for measuring such activities was accurately stated by Lester T. Sunderland, when president of the Portland Cement Association, as follows: "It (the association) undertakes only such activities as are for the common good and whose benefits when utilized flow alike to all contributing members."

Opinions vary widely as to what are proper activities for an association of, say, mineral aggregate producers. We have one association which has built itself up largely by giving its members expert, on-the-job-service in the matter of transportation. By operating through the Interstate Commerce Commission and the car service bureau of the American Railway Association the headquarters staff of this association has secured cars for member companies when they could not have secured cars for themselves. This service has made the association many steadfast friends and assured it of working funds, but it has also alienated some other members who had rather work directly with their railway acquaintances, or had no occasion to use the services of the association in this activity.

To apply Mr. Sunderland's yardstick to this transportation service activity requires the most thoughtful consideration of the best brains in the industry. Is such an activity for the common good, or do only some few producers profit from it? There are arguments on both sides and only a jury of men fully cognizant of all the facts and all the circumstances can arrive at a fair decision. But that decision is of tremendous importance to the future of the association, and the future of the association should be made to fit the decision. That is, the association can hardly look for support from producers who ship by water; or producers who feel that their friendly and intimate relations with the railways are disturbed by such activities. This is not written with any prejudice one way or the other, but merely to emphasize the intricacies of the problem and the desirability of settling it once and for all.

There are other equally interesting and vital questions pertaining to the activities, or proposed activities, of associations which must be faced squarely and fearlessly before the industries which they represent can be expected to put much faith or money into the hands of such trade associations.

Readjustment of Railway Rates

Reduction of railway rates is a term to be avoided in any present discussion of the subject. The railways as a whole are not over-capitalized; and their earnings as yet are not enough to properly finance their operation and make many necessary improvements and additions. And no one has a greater interest in seeing these improvements and additions undertaken than producers of cement and mineral aggregates; and, in fact, the whole rock products industry. Rock product producers are interested because until we have adequate railway facilities and equipment these industries will be cramped and handicapped, and they are interested because the addition and betterment work of the railways, now being held in abeyance, will mean a big market for rock products.

Nevertheless a *reduction* of railway freight rates on many—if not all—rock products must come in the near future. These reductions are bound to come because the present rates are unreasonable and uneconomical. The railways themselves would doubtless welcome lower rates in many instances for purely business reasons; but they *must* have adequate income.

The only way that these two apparently contradictory objects can be attained is by a *revision* of the freight-rate structure whereby a rate in some proportion to the value of the commodity, and the risk of hauling it, can be arrived at. This is a matter touched on by Secretary Hoover in his recent annual report (Rock Products, December 2, page 36). Just what Mr. Hoover said is this:

> The recent reduction of 10 per cent in rates on luxuries, as well as on primary goods, contributes nothing to commerce, and impoverished the railways just that much. The tangled skein of rates seems a mesh in which there is so persistent a resistance against every constructive proposal, that we are incapable of rescue except by some complete departure in courage.

It took courage for a Cabinet officer to say that much. It will take a great deal more courage, as he suggests, to revise freight rates as a whole. Yet that task must be faced sometime; and rock product producers who know full well the injustices and the unreasonableness of the present rate structure so far as their commodities are concerned, certainly have nothing to fear from a fair-minded, equitable *revision* or *readjustment*. They should get behind Secretary Hoover and demand it.

Protection of Pulverizing Machinery

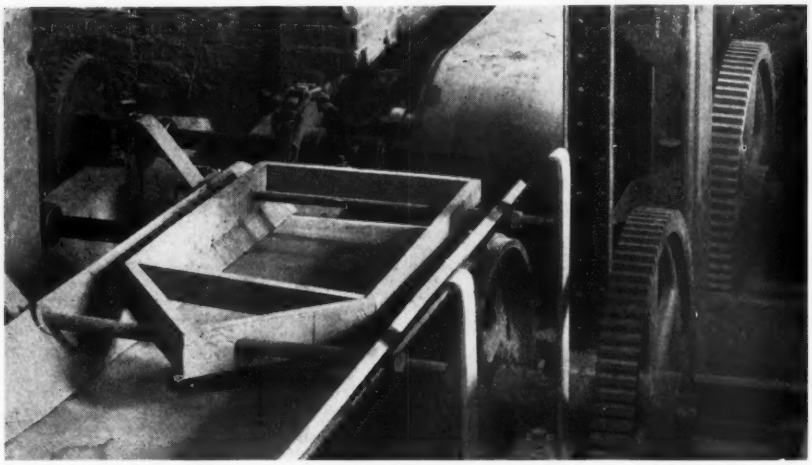
By J. P. Bethke
Chief Engineer, Magnetic Mfg. Co., Milwaukee

IN transporting and conveying all sorts of materials a great deal of foreign material finds its way into the conveyed substance. The principal offender in this line has come to be named "tramp iron"—scrap iron—and steel in various forms.

Since iron is so universally used, and so necessary in all arts and industries, it is obvious that it will be found most everywhere, and especially around industrial plants. This condition is common especially when materials are handled in bulk. In stone quarrying, much iron and steel scrap is occasioned by broken drills, bolts, hammers, workmen's tools, and often car coupler pins, chains, etc.

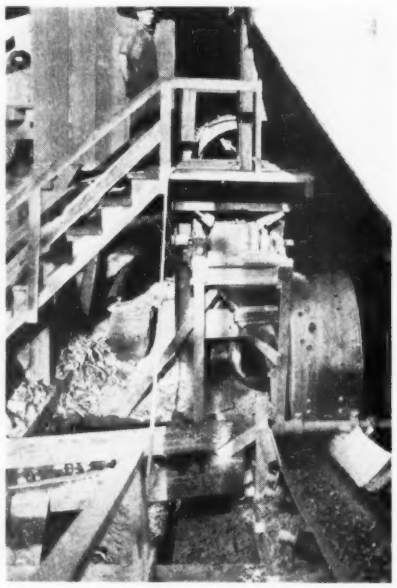
The presence of iron, once it finds its way into a car of rock, is difficult to detect on account of the large bulk of the material it enters. Magnetic pulleys have come to be recognized as one of the only positive means of extracting tramp iron from all sorts of materials, and they have been particularly valuable as a means for keeping crushing plants free from shutdowns due to damages caused by tramp iron.

Carelessness of workmen often causes iron to enter crushing machinery. An instance of this recently occurred in a small agricultural limestone plant. One of the men was sent up to the screen floor to tighten the bearing bolts on a large rotary screen while the plant was running. A large open wrench was used to tighten the bolts and at the first pull it slipped and dropped into the rock bin. The man thought nothing further of the incident and went down to get another wrench. Before another wrench was procured there was a crash from the crusher floor, when a disc crusher broke.



This magnetic pulley—in service in an Eastern plant—removes many pounds of tramp iron per day that would otherwise have gone into the mixing machinery

It is needless to say that the superintendent saw to it that some form of protection was provided for the crushing machinery. A magnetic pulley was installed which effectually prevented any further damage to the machinery



An installation of a magnetic pulley between a screen and disc crusher. Note the pile and the barrel of tramp iron which the pulley removed from the belt

In the most modern plants it has become common practice to incorporate as a part of the equipment a magnetic pulley, or separator, because the experienced operator or engineer has come to realize that tramp iron is ever present and must be contended with. Magnetic pulleys have been proved to be the most reliable form of protection for all sorts of crushing, pulverizing, grinding, and screening machinery, and have been developed by the manufacturers to a point where they are extremely reliable. They can be readily installed in plants already in operation.

How a large Eastern plant, handling sand and stone, is removing all tramp iron before sending the material to a mixer is shown in one of the illustrations. Here magnetic pulleys are installed as driving pulleys on long belt conveyors, and the iron is removed by them just before the material is discharged into a bucket elevator, prior to going to the mixing floor.

The most serious injury in accidents to machinery does not lie in the cost of repairs but in the loss of time and production. Any device that makes for continuity of operation has an appeal to the plant operator. A common fault in plant equipment in the past, has been the selection of machinery of insufficient capacity, poor design or the selection of an insufficient amount of it.

Not many months ago a large lime plant was totally destroyed by fire caused by pieces of iron getting into a certain type of pulverizer. The tramp iron had become red-hot by being whirled about in the machine and when discharged set fire to the timber construction.

Oklahoma Cannot Control Cement Prices

THAT no price monopoly is exercised in the state of Oklahoma by the Oklahoma Portland Cement Co., at Ada, Okla., and the Dewey Portland Cement Co., at Dewey, Okla., was given out in an opinion of the state supreme court recently. Accordingly the court vacated an order of the State Corporation Commission by which the companies were forced to sell cement to individuals.

The court also held that while these companies are the only portland cement companies in the state, they are forced to meet competition from 12 companies in adjoining states, and that for this reason cannot be said to hold a monopoly. The corporation commission order was vacated on the grounds that the state cannot interfere with prices and distribution of a product unless a monopoly exists.

What Machinery Makers Say

Better business in 1922 for manufacturers of equipment indicates better business for the users of that equipment

ACTIVITY in any industry is reflected in the amount of business done by manufacturers of machinery for that industry. Hence unusual activity of these manufacturers ordinarily means that the industry they serve is expanding as a result of increasing demand for the products of that industry.

It is evident that in general, 1922 has been a considerably better year for manufacturers of machinery for the non-metallic mineral industries than 1921, and from that fact we can draw the conclusion that there was a bigger demand and better business for the products of the non-metallic mineral industries in 1922 than in 1921.

It is too early, of course, to get complete or accurate figures that will give a close comparison with previous years, but preliminary estimates of their 1922 business with non-metallic mineral plants made by a number of important manufacturers in this field show that 1922 has been distinctly better than 1921, though perhaps not better than 1920, which was an exceptionally heavy year for most machinery makers in this field. Reports are not sufficiently complete to show this comparison between 1920 and 1922.

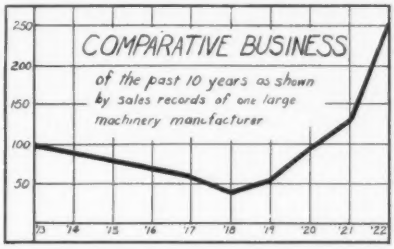
Better Business for Two Large Companies

Two of the largest machinery manufacturers in the non-metallic mineral field report their 1922 sales far above the 1921 figures. One of these, located in the central section of the country, says: "In general, 1922 business in these lines (cement, lime, sand and gravel, crushed stone, etc.), as compared with 1921, is approximately 50 per cent greater." The other manufacturer, located in the east, gives figures of comparative business for the past 10 years, using 1913 business as a base, or 100. These figures, represented on the accompanying chart, show that business fell off steadily during the war years, due, of course, to the substitution of a great deal of war business for regular lines, until in 1918 it was only 40 per cent of the 1913 figure. Then it commenced to climb again, reaching a 30 per cent increase over 1913 in 1921, and a 150 per cent increase over 1913 in 1922. This is an increase of 90 per cent in 1922 over 1921.

The figures of this company are not given as representing the business of every machinery manufacturer, but merely to show the record of one company. It is likely, however, that if other companies making machinery for the non-metallic mineral industries should plot curves to indicate in a similar manner their business over the past 10 years a majority of the curves would roughly parallel the one shown. One of the principal differences would be in 1920 and 1921; the earlier year would show larger sales and the later one smaller sales than those indicated on the curve.

Two other large makers of crushing, conveying and screening equipment, both located in the Middle West, show a marked increase in 1922 sales over those for 1921. One company, showing an increase of approximately 25 per cent, and the other a 10 per cent increase over the best previous year.

A manufacturer of locomotives for quarry



Substitution of war products caused a steady drop in sales to rock products plants, which is more than offset since 1918; 1922 is a banner year, two and a half times as big as 1913

and pit use gives the following figures: In the stone industry, sold in 1920, 29 machines, total 117 tons; in 1921, 12 machines, total 55 tons; in 1922, 29 machines, total 140 tons. In the sand and gravel industry, sold in 1920, 16 machines, total 72 tons; in 1921, 5 machines, total 21 tons; in 1922, 4 machines, total 24 tons. The figures show 1922 to be better than either of the two years preceding in the stone industry, and in the sand and gravel industry about the same as 1921 and not so good as 1920.

Another company furnishing crushing, elevating, screening and similar machinery, reports that "during 1922 our sales of sand and gravel handling equipment have been approximately double that of any previous year; quarry equipment, 75 per cent of normal; no business whatever from the slag or silica sand industries.' The total business of this company for 1922 was slightly below normal, "but from the outlook we expect that the year 1923 will more than make up this deficiency."

A company, of which 90 per cent of the 1922 business was with silica sand plants, shows that 1922 has produced sales of 60 to 65 per cent of capacity, compared with the maximum output of 1917 and 1918, whereas the 1921 sales were only 50 per cent of capacity on the same basis of comparison. Of this 1922 business, about 40 per cent was for new installations and 60 per cent for maintenance and repair of existing plants.

More 50 Per Cent Increases

In the hydrated lime and gypsum fields one company doing business principally in these two industries reports a 100 per cent increase in business during 1922 in the first of these industries and a 50 per cent increase in the second.

A maker of hydrators reports 26 sold in 1920, one in 1921, and eight in 1922. Except for six of the hydrators sold in 1920 and one in 1922, all went to lime concerns. The others went to sand-lime brick and cement companies, with one to a paper mill.

The sales of one company making principally crushers and pulverizing machinery are reported as at least 50 per cent greater than in 1921. The wire cloth furnished in 1922 by another company to gravel, slag, lime, cement, and similar industries, will show an increase of approximately 20 per cent over the best previous year, and 35 per cent over the average of the past five years. The last quarter of 1922 has seen a material falling off in this business.

Speed reduction units furnished by a company specializing in these products have given this company a considerably increased business in the non-metallic mineral industries over the 1921 figures.

A maker of well drills reports that "the past year has been an average year for us in the rock products industries and we have kept our plant going at practically 100 per cent throughout the year."

One eastern company making a rather restricted line of rock products machinery says that "this year and the last have been the two worst years in our history."

In the typical replies given above the favorable reports far outnumber the unfavorable ones. Other reliable sources of information confirm the impression thus given that 1922 has been a considerably better year for the machinery makers as a whole, who supply the non-metallic mineral industries. More complete figures on this subject will be available later.

Modern Conveyor Practice in the Rock Products Industries

Importance of uniform feeds. Types of mechanical feeders. Conveyor practice at crushing plants, sand and gravel plants and in handling lime and finely ground materials

By H. D. Pratt
Engineer, Link-Belt Co., Philadelphia, Pa.

SINCE its earliest beginnings, the art of conveying materials has forced the exercise of a great amount of ingenuity; to adopt standard forms of machinery to many industries, and to produce special designs

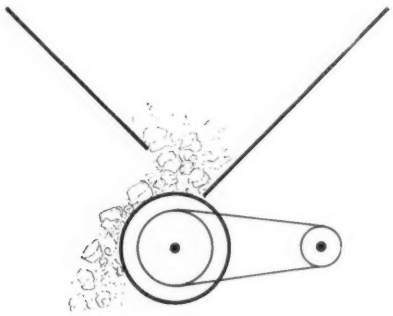


Fig. 1—The roll feeder

when conditions cannot be taken care of with anything that has been used before.

In the quarry business the type of quarry, the lay of the land, the kind of stone, the various kinds of products, the daily tonnage required—all these things determine the "height, breadth and thickness" of the right plant to do the trick.

In the sand and gravel business other things come up to make it hard; the amount of overburden, or stripping, the amount of oversize to be crushed to salable sizes, or rejected as waste; the amount and nature of the clay content; the number of sizes to be produced (often determined by the local market); the necessity of washing the sand and gravel to get a satisfactory product—even the shape of the average pebbles in a pit sometimes is such as to make a more thorough or special cleaning necessary. In producing gypsum rock large pieces of stone, usually "one man size," are often desired by the plaster manufacturer to insure cleanliness; this makes a large, heavy, lumpy material, difficult in mechanical handling in the majority of plants, and results in a great deal of hand labor.

In slate quarries the friable nature of the slate calls for precaution to avoid breakage when carrying the material through its various processes; in some such plants every 100 tons of slate quarried makes but 50 tons of the finished product; the rest is dust—waste.

Some kinds of material, such as slag, trap-rock, and ganister, are particularly abrasive. The wearing parts of conveyors must be designed with this in mind. Some stone, say, cement rock, has the unhappy faculty of building itself up into a dry wall on the slightest excuse, refusing to slide or run. Chutes and buckets must be designed accordingly. In some gravel banks the shape of the oversize stones is round; in others, flat, disc-like pebbles call for steeper chutes. Fine wet sand will not behave through the same bin gate that controls the coarser, freer flowing concrete sand. Some lump lime can be tossed, beaten and kicked around generally, without losing its pristine shape and size; other lime in size and looks the same will, at even a harsh word, crumble to the shadow of its former self, with much undignified dust;

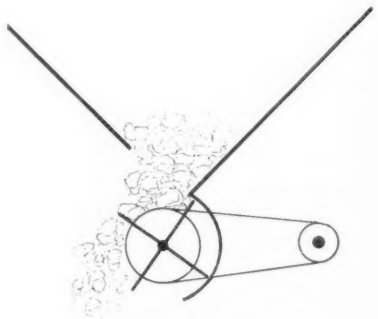


Fig. 2—The vane feeder

here again the conveyor expert must watch his step.

I have seen a silo full of bulk cement with a discharge gate at the bottom where the cement would pack so that nothing but a column 3 ft. in diameter would come out of the gate; the rest forming a well with vertical sides and 30 ft. deep. In contrast to this the next day, perhaps, the same cement will squirt out of a nail-hole like water under pressure. This kind of behavior is true of any fine product which may or may not have the air pressed out of it. An example of this is bulk cement which has been shipped in box cars. On its arrival you can walk firmly on top of the pile; stir it up a little, get a little air in it, and you sink to your fetlocks.

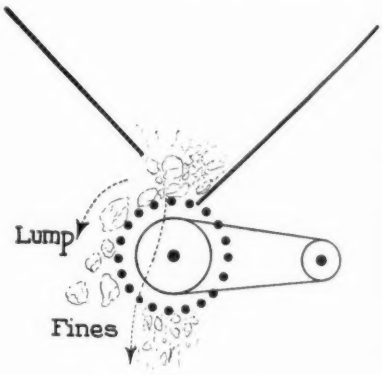


Fig. 3—The squirrel cage

The above are a few examples of the many things that the conveyor man has constantly to keep in mind and guard against. Success in his field requires not only a comprehensive bird's-eye view and knowledge of all the usual forms of conveyors, but also an intimate acquaintance with the material to be handled, its whims and peculiarities. The man who knows his material can pick a better conveyor than he who knows all about conveyors and is not quite sure of what he has to handle with them. The former will probably install better machinery, more weight, longer life, less maintenance. The latter, regarding conveyors as a necessary but expensive evil, looks at the dollar-mark first and the strength

last—and is thoroughly sorry about three months thereafter, all of which means that the "Conveyor Man" has to keep his wits sharpened. He has to sell in competition, to guarantee the machinery to do the work, and to stand back not

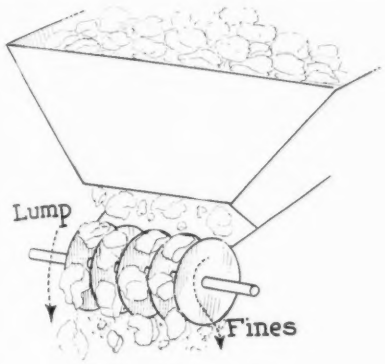


Fig. 4—The disc feeder

only of the parts that compose the equipment, but also of the judgment that recommends the use of this or that type.

Feeder Conveyors

It is the purpose of this article to indicate in a general way the most used methods of handling such products as various kinds of stone, sand and gravel, and lime, through the various processes necessary to bring them into marketable form.

One of the most important things in mechanical handling of materials where the raw material brought to the plant in large intermittent doses is in cars, etc., is a regular feed between the point where the cars dump and the conveying machinery which takes it from that point. The cars bring it in large doses; the conveyor wants it in a steady stream. If you don't reduce the intermittent delivery of the cars to a steady stream, the conveyor system thereafter struggles along much the same as a giraffe who had swallowed a watermelon; the automatic feed at the right point will avoid overloading and distortion thereafter, and permit the use of conveyors and screens of much less capacity—and incidentally less maintenance.

If it is agreed that a regular feed is

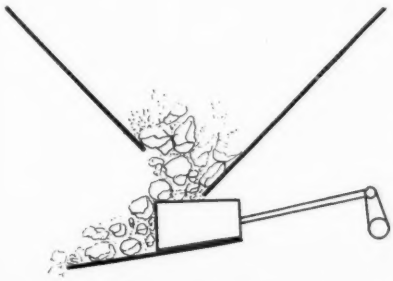


Fig. 5—The plunger feeder

the desirable thing, the question comes up: What kind of a feeder? The adjoining cuts show most of the principles used today in feeding various materials from a hopper or chute. They are all successful in their proper application, the selec-

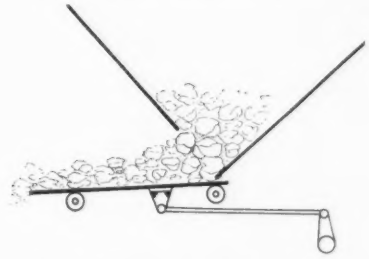


Fig. 6—The reciprocating feeder

tion depending on the size and nature of material, maximum lumps, capacity required, etc. The reciprocating feeder with its ability to handle fine material or large lumps at any desired capacity, and with a low repair bill for repairs and

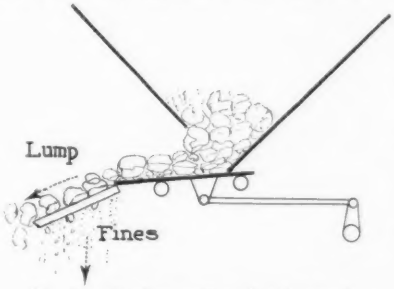


Fig. 7—Reciprocating feeder and screen bars

maintenance, is perhaps, the most generally used type.

Quarry Practice Affects Choice of Conveyor

Quarry plants for the production of stone in sizes suitable for commercial use can be divided roughly into two classes; those in which loading in the

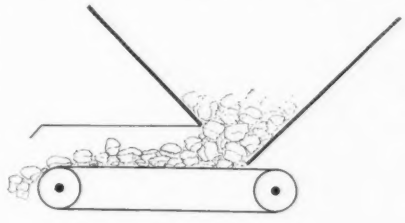


Fig. 8—The apron feeder

quarry is done by hand; and where the loading is done by steam shovel or other mechanical means. The division between these two classes of quarry is determined usually by the capacity which can be economically loaded by hand, or by the necessity of having a brain back of the hand that does the loading, in order to separate the stone into one or more kinds, according to its chemical makeup or appearance.

In hand-loading plants the delivery is usually to carts or cars, the carts delivering to a car to be pulled up an incline to crusher or screen. Hand loaded cars

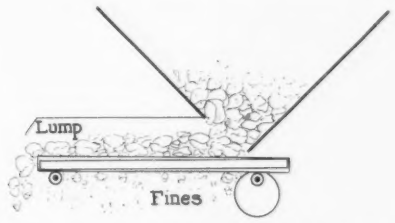


Fig. 9—The reciprocating bar feeder

are often pushed by hand or mule to a central point in the quarry, and there hooked to wire rope on the incline.

If a crusher is used, the car is dumped into it, the stone crushed, and an elevator raises the crushed material and delivers to a screen, which makes the various sizes required; the rejections from the screen being chuted back to the crusher or to a secondary crusher; the crushed product being again passed into the original elevator, so that in order to get into the bin it must pass through one or the other size holes in the screen. This is the "closed circuit" which insures shipping nothing over a stated size.

In a small plant of this kind, where the machinery consists of a crusher, elevator and screen, the first cost and maintenance of the elevator and screen can be greatly reduced by using at the dump over the crusher the proper feeder, to insure a steady, uniform supply to the various conveyor units.

One of the important points often overlooked in steam-shovel operation is continuity of operation, which can be easily obtained by a proper analysis and timing of the cars, or trains. A surprising number of quarries fill their cars in three to four minutes and pull the train away, leaving the shovel idle. The train runs over to the crusher, and in an endeavor to get a lot of work done, the train dumps as quickly as possible and almost chokes the crusher and the elevators (if no feeders are used) to

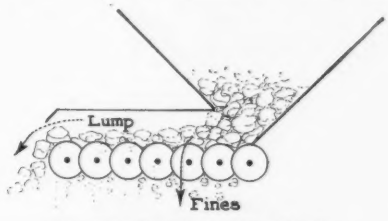


Fig. 10—Revolving disc feeder

death. The shovel in the meantime is standing idle, and about the time the train gets back to it, the crusher has done its job and is turning over idle. This is,

of course, a condition which should be avoided where possible; and often may be avoided by use of another locomotive.

Quarry Conveyor Types

The type of bucket elevator used in most plants of large capacity is the all-metal roller chain design. For high capacities and high lifts the continuous bucket type is used; the buckets being mounted on steel chains of 24-in. or 30-in. pitch, and operating at slow speed, preferably not over 60 to 100 ft. per minute. A properly designed elevator of this type will run for years without repairs of any serious proportions. The head sprockets have renewable wearing teeth, which engage with the chain joints. To save scrapping the whole wheel, the teeth are easily removed without dismantling the elevator. One of the best forms of elevator construction places the rollers which carry the elevator up and down the incline, in the center of the chain pitch, the joints of the chain which engage with the sprockets having a steel driving collar or roller. This brings all the wear caused by the rolling action of the chain on the up and down run of the elevator, on to the separate roller pins, prolonging the life of the chains, and making easy the substitution of new rollers.

Another recent development is the use of the single pin or rod, running through both elevator chains, instead of the former individual short pin in each chain. This construction makes a sort of ladder out of the two chains with their cross rods, and avoids depending on the buckets themselves to keep the chains properly lined up when going up the incline, and especially when passing over the head sprockets. Fig. 11 illustrates this type of elevator.

Belt-and-bucket elevators are used to some extent for crushed stone work, but when the stones are over 4 or 5 in. in size, the chain type is more generally used. A piece of stone as big as one's fist, if it gets between the belt and the bucket, will cause trouble; and for high lifts and high capacities the thickness and resultant cost of the belt compares unfavorably with the steel chains.

Fig. 11—Chain bucket elevator with rod pins

Proper Care of Belt Conveyors in Stone Plants

A few points in the use of belt conveyors in stone plants—one is to load the belts properly. Don't drop the stone vertically from a distance on the moving belt and then wonder why the belt shows gashes and cuts. Get the stone started in the direction the belt is moving, before it lands on the belt. Properly designed box-type chutes can be built of plank, reinforced at necessary points with metal. The life of the belt is greatly increased by their use.

Another point of importance is to use pulleys for the belt conveyor amply large so that the belt bends easily around the pulleys without undue strain.

In an Eastern cement plant recently, where the conveyor had given trouble, delivering stone to a large bin through a tripper, the superintendent put in a new belt in order to eliminate any recurrence of his former trouble. He bought a belt about twice as thick as the one previously used and installed it, with the result that it touched the head pulley, foot pulley and the tripper pulleys, each at exactly one point, being too stiff to bend enough to get in more contact.

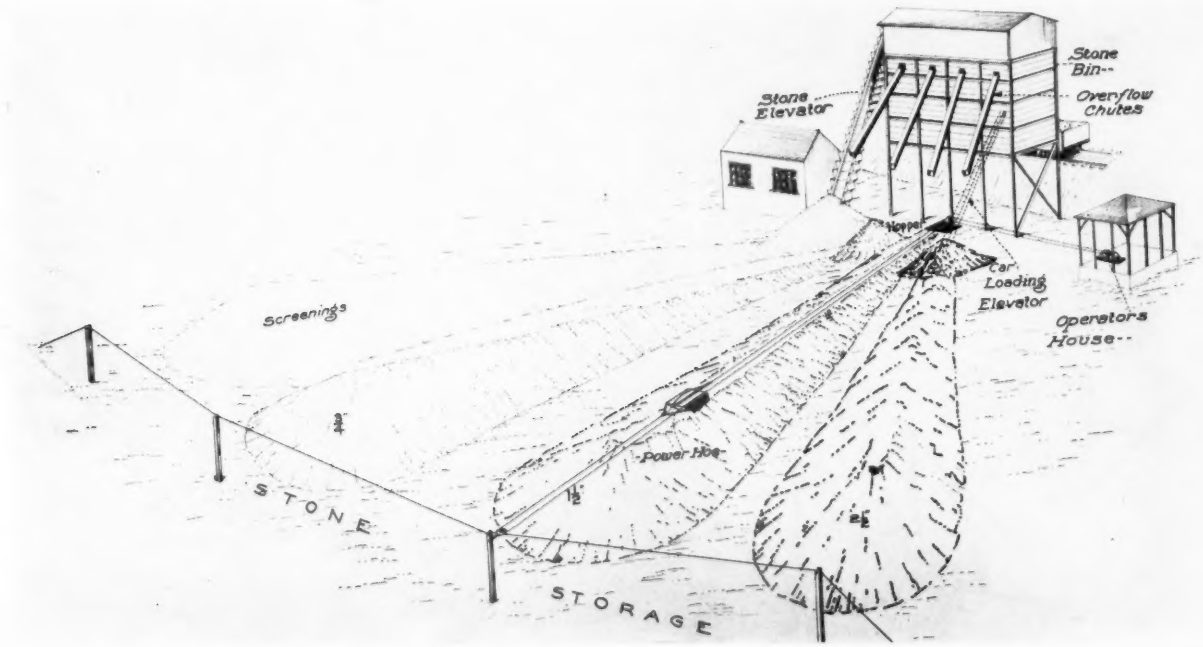


Fig. 12—Ground storage with combination drag scraper and bucket-conveyor recovery

There is another way to get profits out of a belt conveyor. Keep it well loaded up to capacity. The belt deteriorates whether it is used or not.

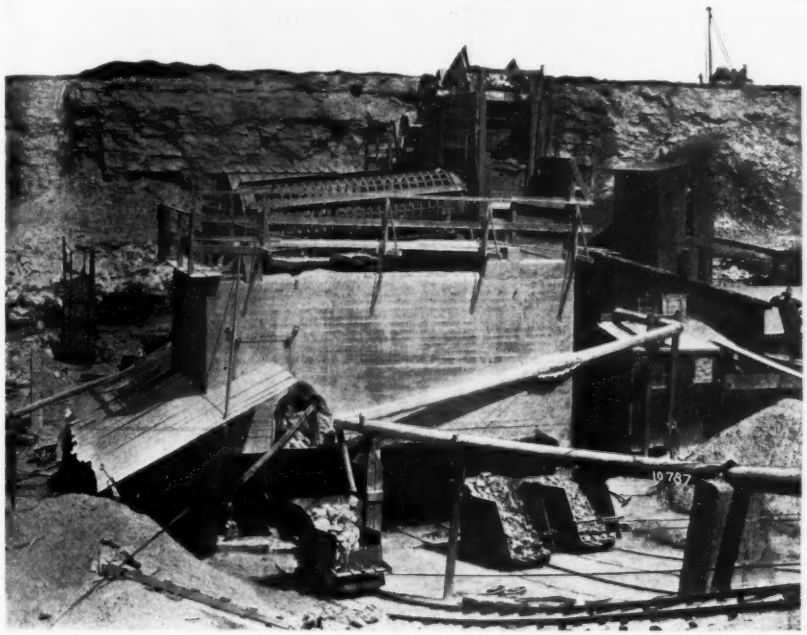


Fig. 13—Stone crushing and handling plant for lime-burning operation

Gravel Plant Operation Affects Selection of Conveyor Type

The remarks made on the subject of proper timing of shovel and cars in the stone quarry apply with equal force to the proper operation of the gravel bank, where regularity of operation is an important item in conveyor design.

Conveyor Storage Systems

In addition to the usual wood or concrete overhead storage bins, delivering to railroad cars through side or bottom delivery gates and chutes, the partition and ground storage type of bins is gaining favor. The screened products fall on to the ground and are kept separate by partitions, and a belt conveyor in a tunnel passes under all the storage piles, is loaded by tunnel gates, and delivers the product to cars. This construction costs less than overhead bins. The partitions act as supports for the screen and separators. No heavy foundations or floor constructions are necessary. The screens are nearer the ground, saving power in lifting the material and washing water. The open storage piles make it possible to increase the amount of storage very greatly by the use of a crane with grab bucket or drag scraper, the material thus stored out being rehandled back to a point where it will run through the tunnel gates.

Excess storage in any stone or sand plant is a very valuable and necessary feature, in order to let the plant operate uniformly during fluctuations of shipments, and to accumulate a surplus for shipment during shutdown. Fig. 12 shows a simple form of layout for this kind of storage.

From each compartment of the stone bin an overflow chute delivers to the ground, these chutes forming small piles in a semi-circle around a hopper in the ground, from which a bucket elevator delivers direct to railroad cars. By the use of a drag scraper with a double-drum engine, and properly located anchorages for the rope sheaves, the small piles can be pulled out into large storage areas, and all of these storage piles can be reclaimed back to the hopper and elevator for delivery to cars. This sort of layout acts as a sort of balance-wheel to the stone or screening plant, as, if any particular size is moving slowly, it can be got rid of without the usual shipment in cars. It can be spilled overboard to the excess storage pile, and quickly and easily pulled out of the way, by the use of the drag scraper, operated by one man.

Lime Plant Conveyor Practice

Lime-plant operators have in the last few years become keenly aware of the economies to be effected by the use of conveyors in doing lots of the jobs about the lime plant. Here the conveyor man has had a new field for his activities, a field where proper design and a knowledge of the results required will often save the total cost of a mechanical installation in the course of a year.

Not only in making the proper size of clean stone for the kilns, but also in drawing the kilns, putting the lime into storage, cooling it, inspecting it for core, taking out the fines, crushing lump, filling barrels, loading box cars, and carrying the fines through the various processes in the hydrating plant, it has been possible to install simple conveying machinery to do nearly all of the operations which formerly required hand labor. Lime is not especially abrasive, and the usual intermittent service of the machine makes for long life of the wearing parts, and low maintenance bills.

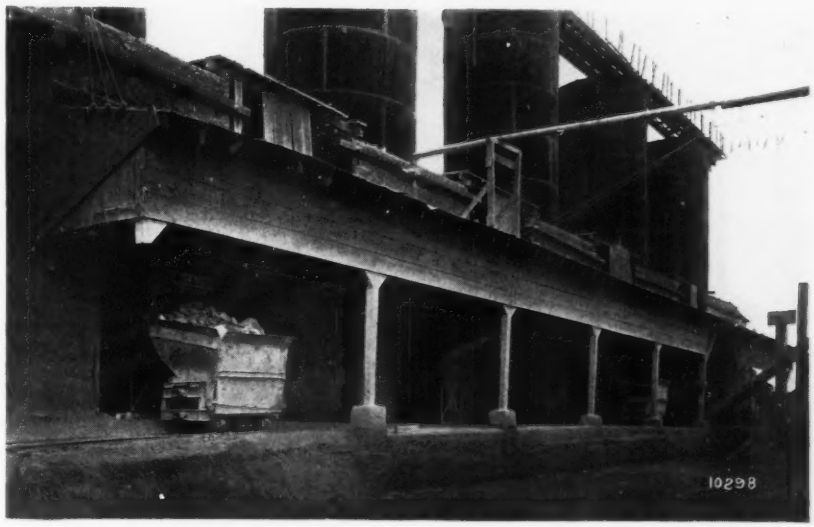


Fig. 14—Simple installation of pan conveyor in an old lime plant

Fig. 13 shows a simple form of mechanical plant for preparing the proper

size of stone for lime kilns. The crusher back of the bin, not shown in the picture, is fed by side dump cars in the quarry and delivered to an inclined pan conveyor which feeds the screen over the concrete bin. The spalls, or small stones, pass through the screen, while the kiln stone, running from one man size to 5 in. or 6 in., is delivered to the end bin, and from this to skips for charging the kilns.

This type of plant is composed of a few simply constructed, heavy units, and which delivers to the box car loader.

A plant of the general type described will pay for itself complete in from one to two years, when installed in a plant having, say, from 8 to 10 kilns and requiring the usual amount of hand labor for drawing, spreading, forking and loading.

For loading box cars, which is always an expensive and unpleasant job, especially in hot weather, there are several ways of mechanical loading in the form of portable or semiportable conveyors.

The preceding paragraphs give indications of how many operations in the lime plant can be taken care of by simple conveying machinery. No two plants, however, are alike, and the various purposes for which lime is used makes a thorough investigation of each plant necessary in order to turn out the required products.

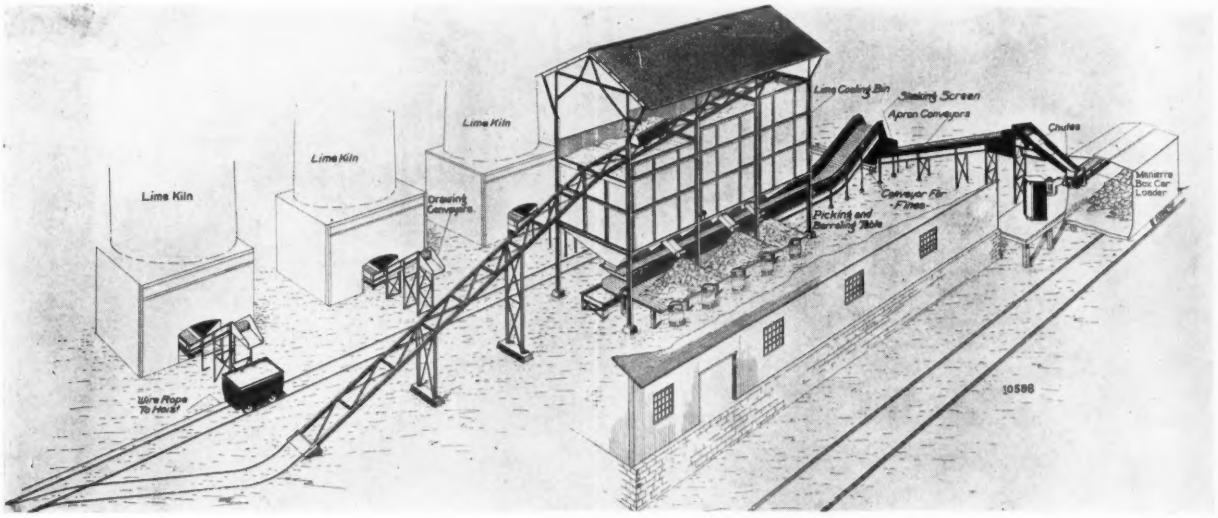


Fig. 15—Typical conveyor service at a modern lime plant

in addition to producing the proper size of stone economically, gives a useful amount of storage between the quarry and kilns.

Fig. 14 shows a simple installation of pan conveyors for drawing kilns and delivering to lime cars. A line shaft running along the face of the kiln actuates any one of the pan conveyors through a chain drive and clutch. On this particular installation a saving of six men was effected, the drawing being now done by one man in the day time, and at night by the fireman.

Fig. 15 shows the mechanical elements of a modern lime-handling equipment. The lime is drawn from kilns by pan conveyors of rugged construction, and each full draw handled by a car which is pulled up the incline over the cooling bin by an electric hoist and automatically dumped into part of the bin. The successive filling of the bin from one end to the other reduces breakage of the lump by letting each carload fall on the side of the previous pile.

The lime after cooling in the bin is automatically fed out on to a pan conveyor, and the fines are taken out by a shaker screen, inspection for core being made on a second pan conveyor

Relation of Operating Hours to Conveyor Type

In the designing of conveying machinery a point often overlooked is determining beforehand the number of hours per day, week, or year the conveyor is to be operated.

The machinery which is run an hour a day can do a lot of satisfactory work, although constructed of parts that would not stand up satisfactorily under 10 or 20 hours' work a day. As a general proposition, the more hours per day a conveyor is to run, the larger and heavier it should be, and the slower its speed of travel.

Conveyors depended upon for 24 hours per day service, or even 12 hours, should be so designed that any moving part that wears can be taken out and replaced in a minimum of time. An example of this is the pan conveyor handling lime from a bin, where the delivery is likely to be any hour of the day or night throughout the year; or a similar conveyor receiving clinker from a kiln. A conveyor of this type usually shows wear first, and chiefly in the rollers on the chain joints. These chain joints should therefore be constructed in such a way that by the removing of a cotter pin and cross rod, new rollers can be installed in a few minutes. The wrong way to build this apron is with the chain pins riveted over, where the replacing of a roller is a much longer job.

Spare parts are always a necessity, and most plant operators find out by experience which are the most necessary spares to have on hand; but a point frequently overlooked is the invaluable feature of using machinery which has as few as possible different diameters of shafting, and adopting standard gear combinations, and diameters of sprocket wheels.

Adequate Lubrication Saves Repairs

Proper lubrication of all machinery handling abrasive materials is about as important as keeping up your life insurance premiums. There used to be a school of arguers who contended that in handling of material that gave off a very abrasive dust, it was better not to oil the conveying parts, in order not to give the dust a place to stick and enter the wearing surfaces. It has been pretty well agreed, however, that plenty of oil and grease pays in the long run. There is one large stone quarry using two extra high and large capacity stone elevators, where each machine is carefully oiled every other day. The results of this care are indicated by the fact that one of these elevators has handled over 3,000,000 tons of trap rock with the renewal only of part of its rollers and a few cross rods.

Increasing Your Dealer Business

By J. A. Bowman
Manager, Burgner-Bowman Lumber Co., Kansas City, Mo.

THE relationship between sand and gravel producers and lumber and building material dealers is a subject that can be looked at from a great many angles. In my opinion, from whatever angle we try to study this, it will eventually work out to show that there is or should be a friendly relationship between the producers of sand and gravel and the retail lumber and building interests.

From the standpoint of the lumber dealer we think there should be the same co-operation between the sand and gravel producers that there is between the lumber and cement manufacturers on one hand and the retail lumber and building material interests on the other. In the first place, the lumber and building material dealer spends money to erect bins in which to store and carry the products you are producing so that at any time a customer may want a small amount of sand or gravel all he needs to do is to drive to the nearest lumber or building material supply company and get this material.

To do this means expenditure of considerable money to provide these bins and places for carrying the stock. It is part of the lumber business just the same as sheds and warehouses for the storage of lumber, cement, coal, etc. The manufacturers of lumber and cement try to make a maximum distribution of their product through the retail dealer. You are producing a product that is now used in most construction projects and its general use is increasing every year. Twenty-five years ago the item of sand and gravel did not interest the average lumber dealer in the country town. There was not one barrel of cement handled then where there are ten now, and I recall in my early experience that our customers largely depended on the rock quarries and sand banks for their supply of these materials. Conditions have changed. The increase in the consumption of cement has naturally caused an increase in the use of sand and gravel.

Now, why should this in any way call for a closer relationship between the sand and gravel producers and the retailers of lumber and building materials?

All the cement that is handled through the retail dealer must have a certain amount of sand and gravel to be used in connection with it, and if we do not carry this material in our yards, we are not only reducing the quantity of sand and gravel handled, but naturally we would be reducing the quantity of cement handled, so anything that will promote the use of cement will at the same time promote the use of sand and gravel. Years ago if farmer Jones wanted to make a floor on which to feed his stock he invariably used cypress. Now, if a farmer wants to make a floor he invariably makes it out of cement. If he uses cement with which to build this floor he must have, to go with this cement, the sand and gravel. It will not benefit him any if he can come to the lumber and building material yard and get the cement unless he can get the sand and gravel to go with it. He does not require enough of either of the articles used in making this floor to buy a car load, so unless it is arranged that he can get these in small quantities the use of these materials is going to be curtailed that much for he could not look to the producer to furnish him with this small amount.

THIS article showing the benefits of greater co-operation between retail material dealers and producers of sand and gravel—and stone and other products as well—is the result of a talk which Mr. Bowman gave before the recent meeting of the Missouri Valley Association of Sand and Gravel Producers. The article deserves the attention of all material producers who have or could have dealer business.

Shall Producers Sell Direct?

One of the problems that has been discussed considerably of late is to what extent should the retail dealer of building material supply the sand that is used in his community. I think without exception that all the producers of this commodity think it is nice for the retailer to carry sand in his yard so that he can supply the small quantities promptly when a customer drives into the yard to get it, but is it fair to ask the retailer to spend anywhere from one to six hundred dollars building bins to take care of sand and gravel and then receive only the benefit of this small trade, while if someone needs a car load the producers ship this direct to him? Is he not entitled just as much to sell to the party who wants the car load of sand as he is to sell to the party who wants a wagon load? If the retail dealers must confine their sales to the class of people wanting only a small quantity I believe it will only be a question of time until they will have to discontinue the selling of this product.

We have for a number of years now been developing a business in sand and gravel that will amount in aggregate to many cars during the year, and good advertising always admits that it is the re-order proposition that creates the great volume of business, so we feel that the car load orders should be handled through the local lumber and building material companies the same as the smaller shipments, and it would be the aim of the sand and gravel producers to work toward the end of making a maximum distribution of their commodities through the retail dealers of lumber and building material. It is true that in some of these large projects where they use a great number of cars of sand or gravel it looks like nice business to the producers to handle it direct, but they overlook the fact that this contractor may want five or ten cars of sand on this project, he does this work, and he goes away probably never to have another contract in their territory. Then who is going to handle their product. The retail building material man is there year in and year out.

The old policy which existed for some time was: "If Mr. A does not buy sand and gravel from me I will ship in on him. I will not respect him as a dealer, and if I have an opportunity will ship direct to a consumer." As long as this policy was followed out two things were likely to happen. If you ship enough cars to the trade, Mr. Dealer will discontinue handling this material and you will not only lose all this small trade and cut down the volume of your business, but your trade will not be as high class as when you disposed of your material through the dealer. The second thing that will happen is that the producer who had been shipping sand to this town to a dealer will sooner or later find out that one of his competitors has dropped in and is making shipments direct to the trade. It would not be human nature if he did not retalliate by finding out where this same producer had a good dealer and make shipments direct to the trade in his territory, so what has been gained? You have not increased the consumption of your commodity one particle and you made dissatisfied customers at two different points.

Where the Dealer Shouldn't Enter

It is true there are some modifications in the handling of this material that should be considered. There are certain classes of work in which the dealer thinks the mate-

rial should be handled direct and no doubt it should be sold direct for the very reason that the margin of profit could not be had so the retailer could afford to assume the responsibility of credit. I refer now largely to the work of federal road contracts. I understand some of the material is handled on a basis of 20c per ton margin. There is a question in my mind whether the retailer can afford to handle, even though he does not stock it, large amounts of material on this margin. It has been our experience that the bills are not always promptly paid. Unless it could be arranged that the dealer practically gets his cash it would be much better that the producer handle this material direct.

It is my view that all sand and gravel on federal aid road projects, state and railroad contracts should be shipped direct and not handled through the retail dealer, but I know that there are others who do not look at it from this same viewpoint. A good reason why it should be to the interest and the advantage of the producer to handle this through the retail building material man is that you who sell your sand and gravel through the retail lumber dealer seldom lose money. You are not worried about the pay. You are selling to men who have regular credit rating and I think usually pay their bills promptly. You are selling to men who are in the market 12 months out of the year. They are not in the market for five cars of sand this week and then none for six months. Business of this kind is hard to handle at any price.

Summing it up, the following are the main reasons why there should be a close co-operation between the producers of sand and gravel and the retail lumber and building material men.

(1.) The dealer has spent money to provide equipment to store for the benefit of the customer who wants small amounts of this material.

(2.) If he knows, when a concrete building is to be constructed in his town, that the material going into this building will be handled through his yard at a fair margin of profit, he will not use his influence to try to change to some other form of construction, which often might be done.

(3.) When selling to dealers the producer is selling to those who have an established credit and as a rule they are prompt pay and he has no worries regarding making his collections. They are in the market the entire year whereas when he sells to the contractor he is only in the market when he has a contract in his vicinity.

(4.) By handling his product through the retail dealer the producer's business is scattered out through the entire year and it is the repeat orders that build up the volume.

(5.) It is becoming more general in all communities that the manufacturer market his product through the retail dealer. If there is no place for the retailer he should get out of business, he should be eliminated entirely. If there is a place for him he should have the hearty co-operation of manufacturers in making maximum distribution of their products through the channels of the legitimate retailer as long as the retailers are willing to do this at a fair margin of profit.

Prices of Rock Products in 1922

THE value of price curves, apart from their historical interest, depends upon the knowledge of conditions affecting those prices which is available in interpreting their meaning. It is particularly necessary, when averages are taken over various points or sections, to keep in mind that the resulting curves show a general trend of the whole which may be entirely misleading if applied to any one point or section.

These facts should be kept in mind in studying the curves on the opposite page. A good illustration of what has been said is seen in the curves for cement prices and for aggregate prices. In the case of cement, the distinct upward turn of the curve during the late summer reflects the rising prices of cement at nearly every shipping point, but applied to Pacific coast prices the curve is entirely wrong, for in that section, where price levels for cement during the summer were considerably higher than in eastern and central states, there was actually a drop in prices.

With the aggregates, car shortage and other conditions resulted in higher prices along in September and October at a number of shipping points, yet this tendency is not shown in the curves because it is more than offset by price decreases at other points, with the result that the aggregate price curves show a downward tendency throughout the year in spite of increases at many points.

Hence in practically all the curves shown, and particularly in those giving prices of aggregates, there are dozens of fluctuations at various shipping points and at various periods, some of them up and some down, which balance one another in the average and have no apparent effect on the final curve.

THE PRICE CURVES

BESIDES the curves showing the average of prices quoted during the year at 15 to 20 representative shipping points through the country, there is given also the maximum range of quotations received, or the highest and lowest figures quoted at any point and at any time. In some cases, also, the average price for different sections are given.

Prices quoted are in dollars and cents per ton in wholesale quantities, f.o.b. cars at producing plant, except in the case of cement, where the barrel is the unit for which the price is given.

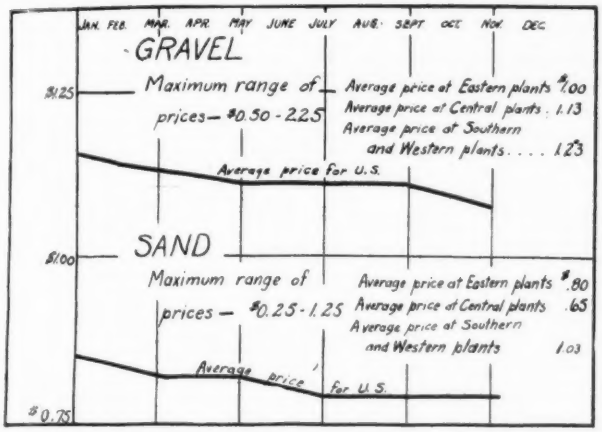
Sand and Gravel

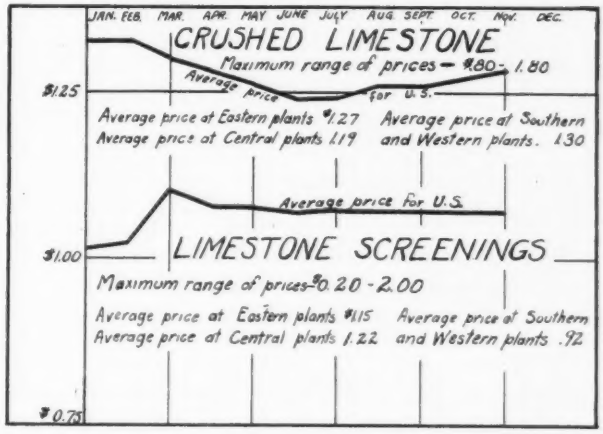
The general level of prices for both sand and gravel is lower than it has been in either of the past two years, but these products have been subject to much less variation in price than during 1921. In that year gravel dropped, as shown in the general price curves of ROCK PRODUCTS a year ago, from $1.28 in January to $1.12 in November, while during 1922 the range was from $1.16 in January to $1.09 in November. A large number of plants reported a constant price throughout the year on both sand and gravel, and this fact accounts for the comparatively flat appearance of the two curves.

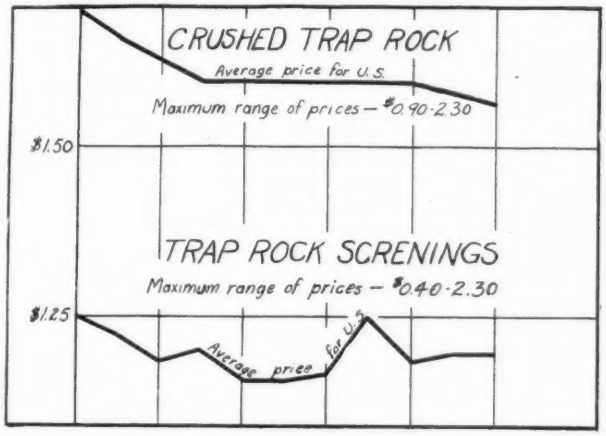
With sand the average price dropped in 1921 from 98 cents to 84 cents, while in 1922 the decline is from 83 cents to 79 cents. It is worth noting that in both years the tendency has been downward, and that the general level for 1922 is lower than for 1921. During 1920 both curves had an upward turn.

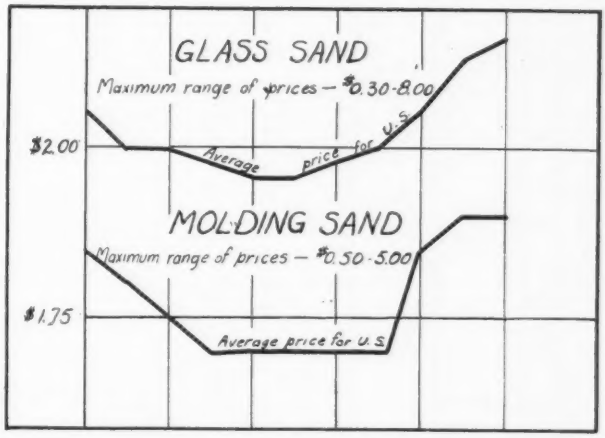
This downward tendency with these two products during two years is due partly, without question to an easing up of the labor situation during that period. Early 1921 prices still showed the effects of 1920's high labor costs, and as the lower wages became generally effective prices reacted to a lower level. An upward turn of wages during the last half of 1922 has not made itself felt in increased prices for aggregate as it has in the case of cement and lime.

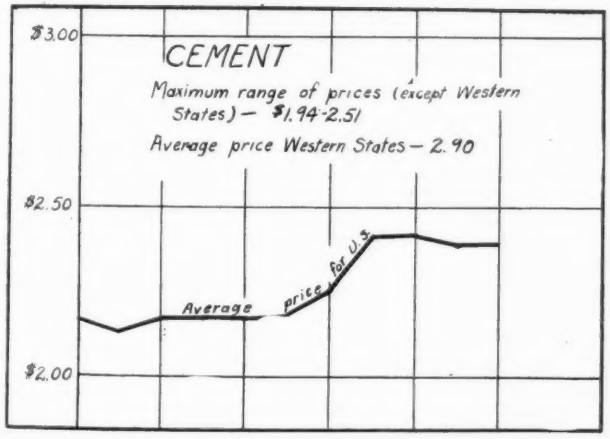
Probably another reason why lower prices are possible is the increasing use of labor-saving machinery in the industry with resulting lower costs of production. New plants are not only being designed and built to reduce the number of men needed, and old ones rebuilt with the same purpose, but they are so planned as to reduce the break-downs and the number of hours the plant is not operating because of breakdowns.

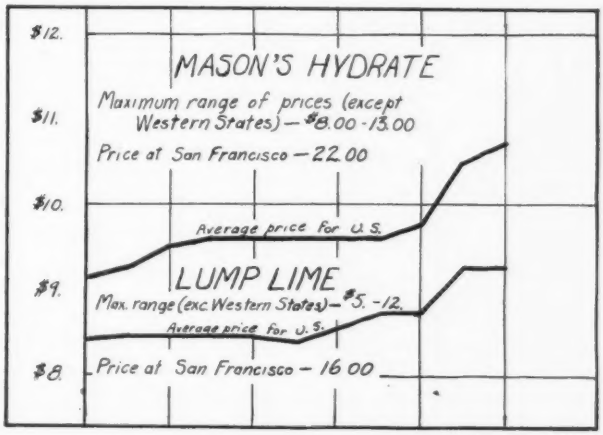

JAN. FEB. MAR. APR. MAY JUNE JULY AUG. SEPT. OCT. NOV. DEC.
GRAVEL
$1.25
Maximum range of prices — $0.50 - 2.25
Average price at Eastern plants $1.00
Average price at Central plants 1.13
Average price at Southern and Western plants 1.23
Average price for U.S.
SAND
$1.00
Maximum range of prices — $0.25 - 1.25
Average price at Eastern plants $.80
Average price at Central plants .65
Average price at Southern and Western plants 1.03
Average price for U.S.
$0.75

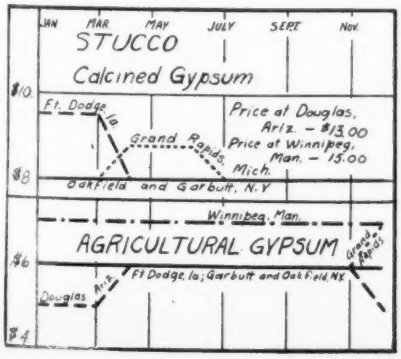

JAN. FEB. MAR. APR. MAY JUNE JULY AUG. SEPT. OCT. NOV. DEC.
CRUSHED LIMESTONE
Maximum range of prices — $.80 - 1.80
$1.25
Average price for U.S.
Average price at Eastern plants $1.27
Average price at Central plants 1.19
Average price at Southern and Western plants 1.30
Average price for U.S.
$1.00
LIMESTONE SCREENINGS
Maximum range of prices — $0.20 - 2.00
Average price at Eastern plants $1.15
Average price at Central plants 1.22
Average price at Southern and Western plants .92
$0.75

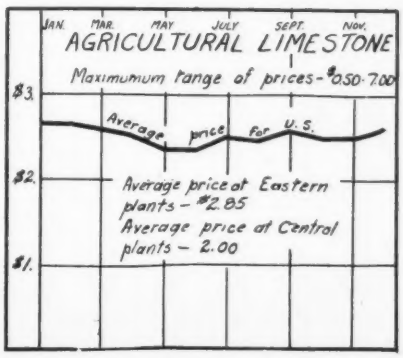

CRUSHED TRAP ROCK
Average price for U.S.
Maximum range of prices — $0.90 - 2.30
$1.50
TRAP ROCK SCRENINGS
Maximum range of prices — $0.40 - 2.30
$1.25
Average price for U.S.

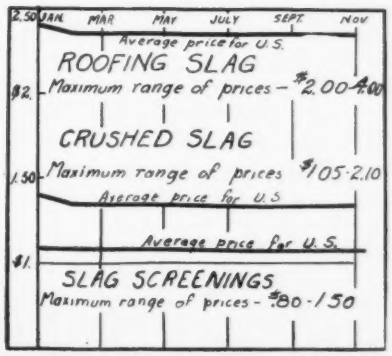

GLASS SAND
Maximum range of prices — $0.30 - 8.00
$2.00
Average price for U.S.
MOLDING SAND
Maximum range of prices — $0.50 - 5.00
$1.75
Average price for U.S.


$3.00
CEMENT
Maximum range of prices (except Western States) — $1.94 - 2.51
Average price Western States — 2.90
$2.50
Average price for U.S.
$2.00


$12.
MASON'S HYDRATE
Maximum range of prices (except Western States) — $8.00 - 13.00
$11.
Price at San Francisco — 22.00
$10.
Average price for U.S.
$9.
LUMP LIME
Max. range (exc. Western States) — $5. - 12.
Average price for U.S.
$8.
Price at San Francisco — 16.00


JAN MAR MAY JULY SEPT NOV
STUCCO
Calcined Gypsum
$10
Ft. Dodge, Ia
Price at Douglas, Ariz. — $13.00
Price at Winnipeg, Man. — 15.00
Grand Rapids, Mich.
$8
Oakfield and Garbutt, N.Y.
Winnipeg, Man.
AGRICULTURAL GYPSUM
Grand Rapids
$6
Douglas, Ariz.
Ft Dodge, Ia; Garbutt and Oakfield, NY
$4


JAN. MAR. MAY JULY SEPT. NOV.
AGRICULTURAL LIMESTONE
Maximumum range of prices - $0.50 - 7.00
$3.
Average price for U.S.
$2.
Average price at Eastern plants — $2.85
Average price at Central plants — 2.00
$1.


2.50
JAN. MAR. MAY JULY SEPT. NOV.
Average price for U.S.
ROOFING SLAG
Maximum range of prices — $2.00 - 4.00
$2.
CRUSHED SLAG
1.50
Maximum range of prices $1.05 - 2.10
Average price for U.S.
Average price for U.S.
$1.
SLAG SCREENINGS
Maximum range of prices - $.80 - 1.50

With only a few exceptions prices at Eastern plants remained particularly steady throughout the year. In the Central and Southern sections there was a tendency to vary, up at one point and down at another, while at the Western plants prices reported showed as a whole a decline toward the end of the season.

Crushed Limestone and Screenings

Crushed limestone, like sand and gravel, showed a general downward trend, but unlike gravel prices the prices quoted on this product started up again in August, and saw a still further rise in October and November, with the result that while average January prices of $1.32 had fallen by June to an average of $1.24, a recovery to $1.28 had taken place by November. During 1921 prices of this product saw a fairly steady decline from $1.50 in January to $1.38 in November. In 1920 this product had a small but steady rise in price.

The drop during the first six months of 1922 can be attributed to practically the same causes that produced the decrease in gravel prices, while the rise during the last six months is an effect of an increasing labor shortage, higher wages, and a big demand because of the great construction activity in both road and building fields. Coupled with these conditions is the car shortage which doubtless had at least a small effect on prices here and there.

Limestone screenings, following a rise in the early months from $1 to $1.10 in average price, remained steady at $1.08 during the rest of the year. This is approximately equivalent to the average 1921 price, which declined from $1.21 in January to $1.02 in November. Screenings show a wide variation in price at different shipping points, from 20 cents at Nebraska points to $2 in Georgia.

Trap Rock

Crushed trap rock, largely because of its higher cost of quarrying and crushing, is the most expensive of the three more common of the coarse aggregates. Like gravel and crushed limestone, trap suffered a decline in general price level from 1921, and also a decline through the year 1922. The average price of crushed trap rock in January, 1922, was $1.70; during the summer it remained constant at $1.59; and in November it had declined to $1.56. During 1921 this same product dropped in price from $1.79 in January to $1.60 in November.

Trap rock screenings dropped from $1.25 in January to a low point of $1.15 in May and June, went back to $1.25 in August and finished the year at $1.20 in October and November.

Glass and Molding Sands

Glass sand at most shipping points suffered a decline in price during the summer months, with a later increase to a higher price at the end of the year than at the beginning. The average price figures show $2.05 in January, $1.96 in May and June and $2.16 in November. The maximum range of prices throughout the industry—the lowest and highest quotations received during the year—is given as 30 cents to $8. This wide range is perhaps misleading. Only one plant quoted as low as 30 cents and only one quoted as high as $8. The large majority of quotations range between $1.25 and $2.75. In 1921 average prices for this product declined from $2.72 to $2.30.

Molding sand prices approximately parallel those for glass sand, at about 20 cents below the glass sand prices. The average price in January was $1.85; from May to August, $1.70; in October and November, $1.90. Here again the maximum range of 50 cents to $5 shown on the chart should be qualified by the statement that quotations from all but three points varied between $1.10 and $2.75. Average prices for this product in 1921 declined from $2.44 to $1.86.

Cement

Cement prices show very markedly the effect of increasing coal prices during the summer months, together with increased labor costs. Beginning at $2.17 in January, the average price drops to $2.13 in February, continues at $2.18 and $2.19 until July, when it starts up and reaches $2.40 in August and September, dropping off to $2.38 in October and November. This does not adequately represent Western prices, which range between $2.60 and $3.20 and show a slight decline toward late summer and autumn in contrast with the sharp rise at Eastern and Central points.

As already suggested, the increase in cement prices is due primarily to coal shortages and higher coal prices, with an increase in labor costs as an important secondary cause.

Lime

Lime and lime products showed the effects of the same conditions which caused an increase in cement prices during 1922. Higher coal prices and a shortage of coal which in itself made operating costs higher because of the idle time resulting, caused a sharp rise in prices in September and October. A rise in wages also had its effect on lime prices, and the heavy demand for the product served to keep plants running full at the necessarily higher prices.

During the first four months of 1922, mason's hydrate rose in average price from $9.15 to $9.60, then in September prices started up again until they reach $10.70 in November. This is an increase of 17 per cent in 10 months.

Lump lime, bulk, showed no increase on the average price curve during the early part of the year, when it remained around $8.40 and $8.45, but in July it started to rise until in October it had reached $9.25.

With the heavy continued demand and permanently higher wages, lime men are predicting that there will be little or no drop from the present higher level of prices.

Gypsum

Little variation is shown in gypsum prices for the year. Stucco, or calcined gypsum, was quoted at $8 at Eastern and Central points, at $10.50 to $11.50 in Nevada, $13 at Douglas, Ariz., and at $15 at Winnipeg. This last price dropped to $13.50 in October. The few variations from these figures are shown on the curve.

Prices were even more constant with agricultural gypsum, $6 being the prevailing price throughout the country, with $7 as the quotation at Winnipeg.

Agricultural Limestone

No distinct trend in prices of agricultural limestone is shown in the average price curve.

The low price of $2.35 occurred during April and May, compared with prices of $2.50 to $2.65 at other periods. As usual, prices at Central points are lower than at Eastern points and Southern points because of the softer nature of the stone which makes it easier to crush and more readily available to the soil even though not so finely pulverized.

The maximum quotation of $7 shown is far above all other prices. Except at this one point, no quotations are higher than $3.75 for the material in bulk.

Slag

Prices for slag and slag products were particularly constant throughout the year. Practically the only change in either roofing slag or slag screenings is shown at the beginning of the year, where a few plants show a drop of from 25 to 50 cents, making a drop of 4 to 5 cents in the average price curves.

A Handbook for Blasters

A NEW and revised edition of the "Blaster's Handbook," in attractive form, has just been issued by E. I. du Pont de Nemours & Co. It was compiled under the direction of the manager of the company's technical section, and is especially valuable at this time to all users of explosives because it reviews blasting practice in every phase and gives the most approved methods of employing dynamite and black powder based on actual field use.

It is profusely illustrated, showing methods of employing explosives under a great many different conditions. Instructions are given on firing; how to handle a misfire; how to use explosives in road and railroad building; side hill cuts; digging trenches; scrapping heavy machinery; blasting old foundations; and all kinds of quarry, mine and farm use. The use of explosives in agriculture is thoroughly discussed. How to handle and store them most efficiently is also pointed out. The book is gotten up in compact, convenient and permanent form and is well arranged.

Lime in 1922

Research to Modernize Lime Makes Big Headway

IN THEIR reports on ROCK PRODUCTS questionnaire lime manufacturers generally state that the reorganization of the National Lime Association was the outstanding feature of 1922 in the lime industry. Reorganization, in this case, means rather an enlargement of its activities and an awakening of interest among lime manufacturers.

The year 1922 saw the greatest activity in building work of any year in history. There was a record production of portland cement; there was a record production of gypsum products; and reports to ROCK PRODUCTS show that the production of lime was from 25 to 50 per cent ahead of production in 1921. It would have to gain that much to recover its own; for lime production has been decreasing rather continuously for the last two or three years.

The future of lime in the construction industry appears to rest on two activities that the National Lime Association has now undertaken in earnest: (1) Chemical research work on the nature and properties of lime with a view to developing some mixture or kind of lime that will have uniform plasticity, quick hardening properties, and other desirable qualities for use in construction; (2) Aggressive salesmanship to market the idea of the use of lime, just as the portland cement industry has marketed the idea of the use of portland cement.

Remarkable progress has been made by the lime industry in the last two years or so in developing a knowledge of the use of lime in the chemical industries. In this connection the National Lime Association has received recognition from scientific organizations, lime consumers, lime producers and government bureaus as a fountain head of information and advice.

The same opportunity exists in the construction field, and is even now being developed by the association. This opportunity means more than reinstating lime in well-known uses in the building field, but the possibility of its use in ways entirely new.

For example the National Lime Association is collaborating in research work in connection with the treatment of soils under highway pavements in order to increase their bearing power or improve drainage conditions; also in the use of lime as a binder in sand-clay roads.

A complete review of the lime industry for 1922 with a statement of its progress will appear in a later issue of ROCK PRODUCTS.

The Biggest Road-Building Year

GREATER progress has been made during the fiscal year 1922 in providing a means of highway transportation than in any similar period in history.

There have been added 10,000 miles of improved highways to the federal-aid roads alone, and no doubt more than an equal mileage has been constructed without federal assistance.

At the close of the preceding fiscal year, completed projects aggregated 7469 miles, with 17,978 miles under construction, which were estimated as being 50 per cent completed. In the past year the completed mileage has grown to 17,716 miles, an increase of more than 10,000 miles. In addition to the 17,716 miles of finished roads, there still remain under construction 14,513 miles which are estimated as being 56 per cent completed.

Of all the roads completed and under construction, more than 60 per cent are of concrete and bituminous concrete construction. With more than 14,000 miles of highways under construction, the outlook for 1923 for sand and gravel and crushed stone producers and cement manufacturers is very encouraging.

The following summary by states of projects completed and under construction is compiled from Tables VI and VII of the *Report of the Chief of the Bureau of Public Roads.*

States	Mileage of completed and paid for projects				Mileage of projects under construction, including those completed but not completely paid for			
	Bituminous macadam Miles	Bituminous concrete Miles	Concrete Miles	Brick Miles	Bituminous macadam Miles	Bituminous concrete Miles	Concrete Miles	Brick Miles
Alabama	.....	23.6	.....	.....	76.4	.....	4.6	.....
Arizona	.....	1.1	52.1	.....	.....	2.9	18.4	.....
Arkansas	3.0	149.1	.....	.....	74.9	16.7	17.4	.....
California	.....	21.4	74.1	.....	55.0	.....	184.0	.....
Colorado	.....	.....	46.9	.....	.....	.....	41.4	.....
Connecticut	7.8	.....	5.3	.....	19.2	.....	41.3	.....
Delaware	.....	.....	21.9	6.2	.....	.....	24.9	.....
Florida	.....	.....	.....	.....	63.4	.....	18.4	44.3
Georgia	48.9	2.5	74.9	.4	6.6	.....	2.9	.....
Idaho	.....	24.6	7.0	.....	.....	.....	14.6	.....
Illinois	3.3	8.1	545.8	13.5	.....	.....	30.7	6.1
Indiana	.....	12.0	79.7	.....	.....	.....	172.3	.....
Iowa	.....	.....	116.7	21.2	.....	.....	150.8	.....
Kansas	.....	.....	69.0	46.4	49.9	.....	212.9	47.1
Kentucky	10.1	.....	17.3	3.9	56.5	.....	15.9	.....
Louisiana	.....	5.7	.....	.....	.....	.....	.....	.....
Maine	32.4	.....	11.8	.....	58.1	.....	19.8	.....
Maryland	27.3	5.8	107.2	.....	.....	5.0	10.8	.....
Massachusetts	55.4	16.9	37.7	.....	33.2	15.5	31.8	.....
Michigan	.....	6.3	73.8	.....	.....	44.7	213.2	.....
Minnesota	.....	22.1	59.2	.....	.....	2.5	127.0	.....
Mississippi	.....	.....	2.6	6.4	5.3	.....	45.3	.....
Missouri	5.2	2.8	47.8	3.5	72.4	.....	109.1	.....
Montana	1.4	.....	25.9	.....	6.5	.....	.5	.....
Nebraska	.....	.....	7.4	7.5	.....	.....	1.8	.....
Nevada	.....	.....	22.2	.....	.....	.....	9.3	.....
New Hampshire	15.4	20.3	.....	.....	6.6	2.2	.....	.....
New Jersey	1.3	2.6	63.4	.....	.....	2.4	52.4	.....
New Mexico	.....	.....	21.3	.....	.....	.....	13.5	.....
New York	14.8	.....	96.0	.....	210.7	.....	225.8	.....
North Carolina	10.6	40.7	26.0	.....	31.8	30.6	8.9	.....
North Dakota	.....	.....	.9	.....	.....	.....	1.0	.....
Ohio	98.9	52.7	161.0	128.8	22.2	20.0	49.6	30.3
Oklahoma	.6	25.8	7.9	.4	.....	.....	126.7	.....
Oregon	.....	35.0	33.5	.....	.....	5.5	24.1	.....
Pennsylvania	7.5	56.8	353.1	22.7	.....	35.3	233.3	.....
Rhode Island	8.7	21.0	2.3	.....	.....	6.6	.....	.....
South Carolina	3.0	8.3	25.1	.2	.....	5.9	22.0	.....
South Dakota	.....	.....	.....	.....	.....	.....	.....	.....
Tennessee	18.5	7.4	.....	.....	214.3	.....	29.6	.....
Texas	16.9	8.9	64.4	1.6	49.9	35.6	87.1	.....
Utah	.....	7.7	4.0	.....	.....	.....	52.9	.....
Vermont	7.6	.....	3.4	.....	.....	.....	.9	.....
Virginia	16.9	.....	36.4	.....	65.2	20.0	67.1	1.0
Washington	.....	.....	120.9	.....	.....	.....	18.6	.....
West Virginia	33.2	11.4	29.6	10.3	46.0	.....	49.1	.....
Wisconsin	7.5	.....	200.5	.....	5.0	.....	48.7	.....
Wyoming	.....	1.2	6.3	.....	.....	.....	12.1	.....
Total	456.2	601.8	2,762.0	273.0	1,229.1	251.4	2,642.5	128.8

Transportation Problems

By Edwin Brooker
Commerce Specialist and Statistician, Washington, D. C.

THIS list, grouped by district freight associations, covers propositions placed before the railroads relative to proposed changes in freight rates of rock products for the past two weeks:

Central Freight Association

No. 5668. Sand and Gravel—Anderson, Ind., to Chesterfield, Daleville, Yorktown and Muncie, Ind. Present 70 cents. Proposed 60 cents per ton.

No. 5690. Slag, Ashes and Cinders—Warren, Ohio, to:

	Present Cents	Proposed Cents
Newton Falls, Ohio	50	40
Lordstown, Ohio	170	50
McDonald, Ohio	180	40
Clarks, Ohio	80	60
Middlefield, Ohio	60	50
West Farmington, Ohio	50	40
Niles, Ohio	160	40
Youngstown, Ohio	180	40
Lowellville, Ohio	210	50
New Castle, Pa.	210	70
Negley Branch, Pa.	240	70
Ellwood City, Pa.	240	90
Celia, Pa.	260	90
Zelienople, Pa.	260	90

Illinois Freight Association

No. 842A. Crushed Stone—Kankakee, Ill., to stations on the Southern Railway as follows: Mt. Carmel, Mauds, Belmont, Browns, Albion, Ellery, Golden Gate, etc., 140 cents per ton; Hoffman, Posey, Zachary, Germantown, Shiloh, Belleville, Ill., etc., 154 cents per ton. (Above rates subject to 10 per cent reduction.)

No. 1572. Sand and Gravel—Forreston, Ill., to Polo, Dixon, Amboy and Mendota, Ill. Proposed 70 cents per ton.

No. 1575. Crushed Stone—Kankakee and Lehigh, Ill., to Westville, Georgetown, Harris Spur, Ill., 76 cents; to Snyder, Trimble, Ill., 101 cents; to Ledford, Stone Fort, Ill., 139 cents; to Paris, Midland, Dueley, Ill., 101 cents; to Rising, Mahomet, and Harris, Ill., 88 cents per ton.

No. 1577. Lime (in bulk)—Hannibal, Mo., to Keokuk, Ia., 6 cents per 100 lb.

No. 1581. Proposed cancellation of 75 cents per ton from Alton, East Alton and East St. Louis, Ill., to Springfield, Ill., via Illinois Central railroad.

No. 1583. Sand and Gravel—Ottawa, Ill., to Milan, Ill., 126 cents per ton.

No. 1379B. Moulding Sand—Vandalia, Greenville, Lutz Spur and Mulberry Grove, Ill., to Freeport and Dixon, Ill., 198 cents per ton.

No. 1495A. Cement—St. Louis, Continental and Prospect Hill, Mo., to White House, Weaver Hill, Mill Creek, Elco, Gravel Pit, Tamms and Sandusky, Ill., 13 cents per 100 lb.; to Hodges Park, Cache, Beech Ridge and Cairo, Ill., 13½ cents per 100 lb.

No. 1597. Sand and Gravel—Joliet, Ill., to Dana, Minonk, Benson, Roanoke, Eureka, Washington, Cooper, Crandall, Morton, Graveland and Pekin, Ill., 88 cents per net ton.

No. 1600. Sand and Gravel—Chillicothe, Ill., to Cooper, Crandall and Morton, Ill., 88 cents per ton.

No. 1526A. Sand and Gravel—To Centralia, Ill., from Metropolis and East St. Louis, Ill., 100 cents per ton; from Kellogg and Chester, Ill., 98 cents per ton. To Marion, Ill., from Joppa and Metropolis, Ill., 88 cents; from Cairo, Ill., 100 cents; from Rosiview and Shetlerville, Ill., 75 cents; from Brookport, Ill., 88 cents. To Murphysboro, Ill., from Cairo, Ill., 90 cents per ton.

No. 1598. Crushed Stone—To Dubuque, Ia., from Hillside, Ill., 139 cents; from Rockford, Ill., 113 cents per ton.

Southern Freight Association

No. 8268. Cement—Rockmart, Ga., to Leaksville, Spray, Draper, Fitzgerald, N. C. and Martinsville, Va., 25 cents per 100 lb. Proposed basis one cent less than present rate from Leeds and Birmingham, Ala., and Richard City, Tenn.

No. 8277. Sand—Emerson, Granite, New Pit and San Pit, Va., to Greenville, Farmville and Wilson, N. C. Present 147 cents. Proposed 140 cents per ton. (The same as in effect from Norfolk, Va.)

No. 8281. Slag—Birmingham group to stations on the Tallahatchie, Swan Lake, Blue Lake and Charlestown districts of the Y. & M. V. R. R. Proposed 187 cents per ton. (Same as in effect to Webb, Miss.)

No. 8289. Sand and Gravel—Jackson's Lake, Ala., and group points including Pruitts, Montgomery, Cooks and Mitylene, Ala., to Albany, 158 cents; Fitzgerald, 167 cents; Macon, 162 cents; Moultrie, 162 cents; Rome, 176 cents; Savannah, 194 cents; Valdosta, 176 cents; Waycross, Ga., 176 cents and Jacksonville, Fla., 194 cents per ton. The proposed rates are based on the proposed scale submitted to the Georgia and Alabama commissions based on average mileages.

No. 8290. Slag—Cumberland Furnace, Tenn., to Paris, 102 cents; to McKenzie, 102 cents; to Memphis, Tenn., 113 cents per ton. Proposed rates are in line with rates on crushed stone from Minns and Newsome, Tenn.

No. 8295. Cement—Spocari, Ala., to points in Georgia and to Jacksonville, Fla. The present rates on cement from Spocari, Ala., it is stated, will not permit shippers to compete with shippers located at Birmingham and Leeds, Ala. It is therefore proposed to revise present rates, placing Spocari on a parity with Leeds by publishing same rates from Spocari as are in effect from Leeds to common points in Georgia on and south of the Seaboard Air Line Ry. from Omaha to Savannah, Ga,, including Jacksonville, Fla., and to points north of this line, but south of the line of the Georgia railroad. From Atlanta to Augusta, Ga., the rates will be 2 cents per 100 lb. higher than from Leeds.

No. 8339. Cement—Richard City, Tenn., Dove, Hass Mill, Garber, Keplinger and Embreeville, Tenn., 17 cents per 100 lb.

No. 8349. Cement—Portland and Rockmart, Ga., to Seaboard Air Line Ry. stations between Charleston, S. C., and Savannah, Ga. It is proposed to adjust the rates to these points on a basis relative with corresponding stations on the Atlantic Coast Line railroad. Following are illustrations: To Primrose, 16 cents; to Butler, 17 cents; to Levy, 17 cents, and Gaza, 18 cents per 100 lb.

No. 8369. Lime—From Aspen Hill, Summitville, Burns and Sherwood, Tenn., Chisca, Cumberland and Lime Rock, Ala., and to Mobile, Ala., on basis of present rate to New Orleans, La.

No. 8383. Cement—Ragland, Ala., to Standing Rock, Ala., 13 cents; to Ashland, Ala., 13½ cents; to Bains, Richardson, Jackson Spur, Brothers, and Laurel Hill, La., 19 cents; to Turn Bull, Ashwood, and Woodville, Miss., 19 cents per 100 lb.

No. 8384. Cement—Ragland, Ala., to Alabama, Tennessee and Northern railroad stations in Alabama, located between Browns and Fairford, inclusive. At present there are no through rates in effect and lowest combination applies. It is proposed to publish through rates based on lowest combination.

No. 8390. Crushed Stone—Cobb City, Rock Spring and Rock Spring Quarry, Ala., to New Orleans, La., 169 cents per ton. (Same as from Lagarde, Ala.)

No. 8393. Sand and Gravel—Sandy Hook, Tenn., to various stations on the Louisville & Nashville railroad rates varying from 3½ to 6 cents per 100 lb.

No. 8414. Cement—Leeds, Ragland and Spocari, Ala., and Richard City, Tenn., to stations on the Northwestern railroad of South Carolina between Sumter and Willsons Mills, S. C. It is proposed to revise present rates on basis of lowest combination in connection with Agent Kelly's Combination Rules Tariff.

Southwestern Freight Bureau

No. 7102. Sand, Gravel and Crushed Stone—Glenwood, Ark., to Haynesville and Homer, La., 9 cents per 100 lb.

No. 7124. Sand, Gravel and Crushed Stone—Memphis, Tenn., to Transylvania, La., 9 cents per 100 lb.

No. 7158. Sand—Armourdale, Kansas City and Sirridge, Kans., to Kansas City Southern Ry. stations in Arkansas (Siloam Springs and north to Sulphur Springs, inclusive), 7 cents per 100 lb.

No. 7174. Gravel—Shawmut, Stanley and Wright, Ark., to Shreveport, Cedar Grove and Gas Center, La., 7 cents per 100 lb.

No. 7178. Cement—Ada, Okla., to stations Foster to Morgan Jct., La., inclusive, on the Vicksburg, Shreveport & Pacific Ry., 22 cents per 100 lb.

No. 7182—Sand, Gravel and Crushed Stone—It is proposed to provide an exception to the effect that class rates named in S. W. L. Tariffs 8 and 21, will not apply on these commodities when moving from, to or via the Gulf Coast Lines, in order to permit rates to be made on the lowest combination of locals.

Western Trunk Line Committee

No. 2556A. Sand—Bay City, Wis., to Chicago, Ill. Present, 11 cents. Proposed, 9½ cents per 100 lb.

No. 2861. Sand and Gravel—Oregon, Ill., to Independence, Mo. Present, class E rate. Proposed, 15½ cents per 100 lb.

No. 2855. Sand—Kansas City, Mo., to various Chicago, Rock Island & Pacific Ry. stations as follows:

To	Present	Proposed
Randolph, Mo.	72	60
Birmingham, Mo.	72	60
Liberty, Mo.	72	70
Chandler, Mo.	73	70
Kearney, Mo.	73	80
Holt, Mo.	73	80
Lathrop, Mo.	73	80
Turner, Mo.	73	80
Keystone, Mo.	73	90
Cameron Jct., Mo.	85	90
Cameron, Mo.	85	90
Mabel, Mo.	85	100
Winston, Mo.	85	100
Weatherby, Mo.	85	100
Altamont, Mo.	85	100

Trunk Line Association

No. 10859. Sand and Gravel—Jersey City, N. J., to Manville-Finderne, N. J., inclusive, to Chatham, Fredericton and St. John, N. B., 39 cents per 100 lb.

No. 10860. Sand and Gravel—Stations from Freehold to Bayside, N. J., inclusive, to Chatham, Fredericton and St. Johns, N. B., 41½ cents per 100 lb.

No. 10867. Sand, Glass and Moulding—To Johnstown, Pa., from Cumberland, Md., 8 cents; from Hancock-Berkeley Springs district, 9 cents per 100 lb.

No. 10868. Furnace Slag—Netcong and Wharton, N. J., to Stroudsburg and East Stroudsburg, Pa., 90 cents in bulk 110 cents per ton when not in bulk.

Wisconsin to Buy Year's Cement Supply

COMMUNICATIONS have been sent out by State Engineer A. R. Hirst to all highway commissioners of Wisconsin advising that the Wisconsin State Highway Department contemplates opening bids on January 5, for furnishing the state with cement for the year 1923.

The commissioners were also advised that counties will profit by the privilege of having the state purchase their yearly supply of cement at the same price that the state purchases it.

In this way the state hopes to purchase its yearly supply at dealers' prices, which will be approximately 10 cents cheaper than individual counties have purchased it in the past.

Questions and Answers

Edmund Shaw, Consulting Engineer, Chicago, Ill., Expert on Problems of Screening, Washing and Hydraulic Separation

THE TECHNICAL STAFF OF ROCK PRODUCTS

Edwin Brooker, Washington, D. C., Consulting Expert on Matters of Transportation and Freight Rates

12. **Definition of Ottawa Sand.**—What is meant by the term Ottawa sand, and if possible, give us specifications covering this material.—J. B. V., Alabama.

A.—The standard Ottawa sand is a sand which is made from crushed silica rock found in the vicinity of Ottawa, Ill. It is a very pure silica and crushes to an exceedingly uniform product (all between 20 and 30 mesh) so that it makes the standard of comparison with other sands. It is not a particularly good concrete sand as many local materials with greater variety of grain sizes show tests with cement better than the Ottawa standard.

Nearly all sand specifications are based on tests of concrete briquettes and the standard by which the briquettes are measured is a mixture of cement and standard Ottawa sand.—G. M. E.

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13. **Rotary Lime Kiln Capacity.**—What size rotary lime kiln is required to produce 10 tons in 24 hr.? Will you also give me the name of a book or some other source from which I can obtain the capacities of various sizes of lime kilns? It is our intention to equip the kiln with oil burners.—A. H. B., Canada.

A.—Ten tons per day with a rotary lime kiln is a very small production, as the smallest rotary kiln in the lime industry of which we have any knowledge is 6-ft. inside diameter by 60 ft. long and produces about 25 tons of lime per day. You can see that a rotary kiln, to produce so small an amount as 10 tons per day would be too small for a man to work in, as the kilns have to be lined occasionally.

It occurs to us that the proper apparatus for a lime manufacturer to produce 10 tons per day is a shaft kiln, which is more economical in fuel than a rotary kiln. There are several shaft kilns in California which operate with oil burners.

In the March 25 issue of Rock Products, on page 24, you will find an article by A. E. Truesdell, consulting engineer, on "Lime Burning in the Rotary Kiln." This should be of much value and interest to you.—N. C. R.

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14. **Preventing Sand from Drifting from Beaches.**—A large part of our traffic deals with sand taken from the sea beach. The position is very exposed and, in consequence, we find that a large quantity is blown away. Can you furnish us with particulars of any methods by which the sand may be trapped or prevented from being blown away? Would you suggest anything in the nature of screens or the erection of some sort of cover?—P. B. M., Leith, England.

A.—This is a subject that has been given considerable thought by engineers of the city of New York in saving beaches from wasting away along the south shore of Long Island. Briefly, the only thing that we can say is that all of these methods are similar to what we call in this country "snow fences."

Snow fences are portable fences set up by an A-frame at the ends, and are made of boards about 10 in. in width. These fences are placed parallel to many miles of railway track in the wintertime and are designed to obstruct the drifting of snow so that the snow will be deposited before it gets to the railway track.

Through the desert sections of Arizona and New Mexico the railways often use similar "snow" fences to keep sand from drifting across the tracks.

We believe that some sort of a portable fence erected to the windward of your beaches would have something of the same effect on them.—N. C. R.

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15. **Jigging out Shale and Making Fine Sand Separation**—We desire any information you can give us relative to concerns manufacturing jigs suitable for jigging shale from sand and gravel; also any information concerning such work which may have appeared in Rock Products. As the writer carried on the experiments at Appleton, Minn., for the Minnesota Pipe and Tile Co., references to these may be omitted.

We are also interested in a method of separating minus 20 mesh sand from sand and gravel pumped by a 10-in. centrifugal pump, the maximum solids in the discharge being 20 per cent and the minimum 12 per cent. The sand is to be passed over a four-mesh screen before the 20-mesh separation is made.—J. A. M.

A.—We know of no jig that is regularly manufactured for the separation of shale from sand and gravel. Experiments, such as those you carried on at Appleton, Minn., are being made with different types of jigs in various parts of the country, but we have no accurate information as to their success. The writer's own experience is limited to a single experiment made with a movable sieve jig, and this was not sufficiently promising to warrant a continuance with the device used.

This experiment was with gravel. With sand we have had some success in making a similar separation with hindered settling classifiers, and expect shortly to install these in a plant on a working scale. Since the jig and the hindered settling classifier depend on similar principles, it would seem that the jig ought to be successful, provided the difficulties of design can be overcome.

Regarding the separation of 20-mesh sand and finer from the discharge of a centrifugal pump, this appears to be best done by classification. Either hindered settling, hydraulic, or surface current classification could be used, depending on the exactness of the separation necessary and the way the plant is laid out. It seems that you have in mind using surface current classification.

A considerable experience with separations of this kind has shown that their success is dependent on the regularity with which the separating device is fed. None of these methods will give satisfactory results unless the water feed is constant and the process is affected, although to a less degree, by variations in the amount of solids fed.

A pump of the type you mention is bound to give heavy fluctuations in both the solids and the water in the discharge. For this reason good separation by classification will be impossible, unless something precedes the classifier which will take up these variations and insure a steady feed to the classifier. There is an old device for doing this called a "stay box," or a "surge tank," which is merely a large tank with an overflow and a pipe discharge of some kind to feed the classifier. Excess water is thrown off at the overflow and variations in the solids are taken up in the volume of water in the tank.

One form of this device is illustrated in the article on "The Design of Sand Plants" in Rock Products for December 16.—E. S.

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16. **Silica Sand Near San Antonio.**—We are considering the establishment of a plant in San Antonio, Texas, and are looking for some point near this location where we can purchase our supply of silica sand. The freight rates from the point where we are now buying are prohibitive. We have been advised that you can probably furnish us with this information.—B. V. R., Michigan.

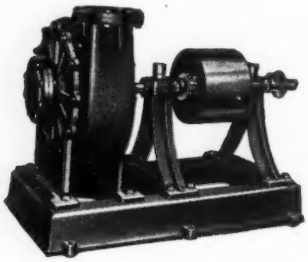
A.—A list of sand producers has been sent this party. Rock Products will be glad to hear from any producer in a position to ship silica sand to San Antonio.—N. C. R.

New Machinery and Equipment

Special Features on Suction Pump

THE Kansas City Hay Press and Tractor Co., Kansas City, Mo., announces a special feature of its centrifugal pumps, for both water and sand.

One of the features of the dredging pump is the use of ball thrust bearings to take care of the end thrust. According to the company, the end thrust is the biggest trouble maker in a pump of this character, and the method employed to take care of it is said to be a decided advantage over the old method of using plain collars to take the load.



In this suction pump the ball thrust bearings take care of the end thrust

The castings are extra heavy throughout and the shell, sides and runner are of semi-steel. The runner is provided with sides cast on it so that the material is retained until proper place for discharge.

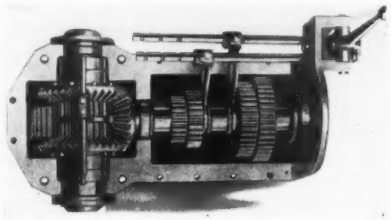
The stuffing bearing side is fitted with a special brass sleeve that is so arranged that clear water runs through the sleeve. This prevents sand from getting into the stuffing box while the pump is in operation, thus preventing the shaft and bearing from being cut.

The pump is equipped with a set of threaded flanges so as to attach the pipes to the pump without the necessity of first having to buy bolts and flanges. The pump is so constructed that the operator can get any angle of discharge he desires. Although the pump is built right-handed, it may be made left-handed by reversing the shell and substituting a left-hand runner.

Gasoline Locomotive Develops Remarkable Drawbar Pull

IN THE seven-ton, four-speed, gear drive gasoline locomotive announced by the Fate-Root-Heath Co., Plymouth, Ohio, the manufacturers claim that in actual haulage test it developed and maintained a drawbar pull of 5250 lb. on sanded rail. The four speeds are 2½, 4, 8 and 12 miles per hour, either forward or reverse.

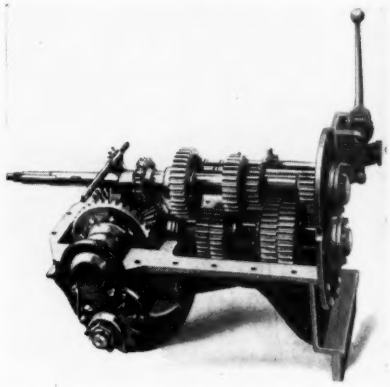
This remarkable showing is claimed to be due to the unique design and construction of the transmission. The gears are unusually large and massive, an exclusive feature being the final driving gear, 14½-in. diameter by 4-in. face. This gear permits of the proper speed reduction and also places the sprocket shaft which it drives on the same plane with the axles, so that no jackshaft is required. The other gears are 2-in. and 2¼-in. face, of large diameter.



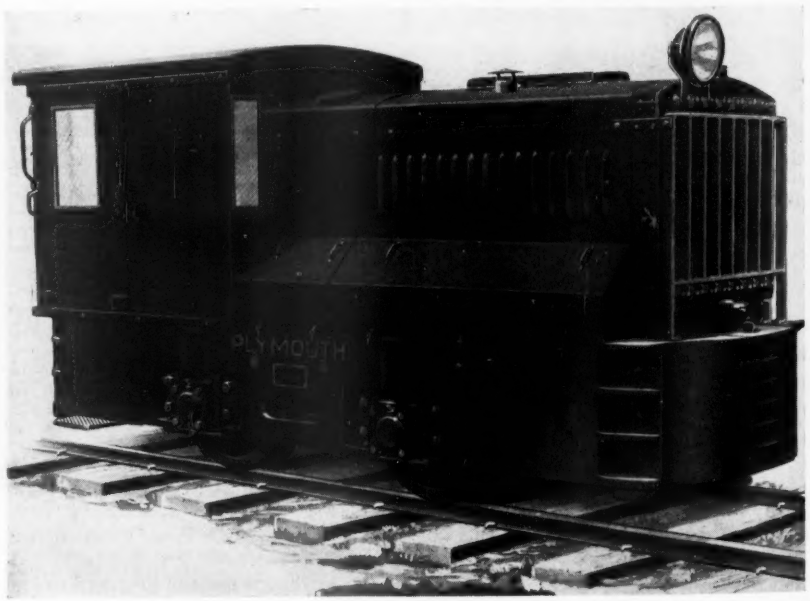
Partially assembled transmission showing reversing gearing and massive final driving gear 4x14½ in.

The sliding gears are made in pairs on the second driving shaft, giving extra long hub length and reducing wear to a minimum. The gears that are driven are the only ones in mesh. Forward and reverse speeds are obtained by large bevel gears with internal gear teeth into which the pinion that drives the main gear meshes, thus doing away with clutches.

All of the gears are of alloy hardened steel, mounted on extra large shafting and ball bearings. The bearings are all inside gear case from which they receive their lubrication, requiring no special attention and insuring permanent alignment at all times. The final drive is by means of two short heavy chains, one to each axle, driven direct from the transmission.



Built transmission with cover removed

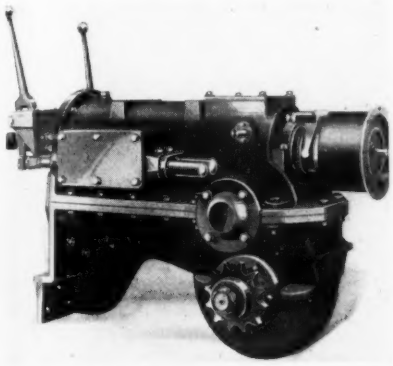


A seven-ton, four-speed, gear-drive, gasoline locomotive

The power plant is a Buda heavy duty

engine, four-cylinder, 5x6½, equipped with Bosch high-tension magneto, Bosch starting and lighting; Pierce governor and Stromberg carburetor; radiator is Modine sectional core type, cooled by 24-in. fan and protected by heavy steel guard.

The clutch is of the dry plate type, with nine driving discs faced on each side with non-burnable facings. They do not require oiling and are very smooth in action.



Completely assembled transmission and clutch

Axles are mounted on Hyatt heavy-duty roller bearings, with hardened steel sleeves to take the wear. The axle end thrust is taken by bronze thrust plates placed in the axle boxing caps, which provide perfect lubrication. The axle springs are 12¾-in. long, so that the wheels readily follow the uneven track, make easy riding and giving excellent traction.

The brakes are placed between the wheels, the brake shoe covering both the tread and flange of the wheel. The lever type of brake rigging is used, producing the same pressure on all four wheels regardless of wear on wheels or shoes.

The sand boxes are high behind the engine, which keeps the sand warm and dry and the sand pipes hug the rails, placing the sand directly on the rails. The valve does not slide on its seat, thus preventing wear. The sand is agitated when the valve is opened, insuring positive flow.

The frame is of massive construction and built close to the track. The bumpers are arched so as not to derail the cars in rounding sharp curves. The cab and canopy are of all-steel construction, easily disassembled. The cab has a side as well as a rear entrance, affording greater safety, and is provided with wired glass windows.

All-Steel Blast Hole Drill

IT is announced by the Armstrong Mfg. Co., Waterloo, Iowa, that it has placed on the market a new all-steel blast hole drill. This company has for many years been building blast hole drills made of part steel and part wood, but found this construction unsatisfactory, for the reason that wood deteriorates fast, and the bolts which hold the parts together work loose quickly, owing to the contsant warping and twisting strain to which the machine is subjected in hard rock drilling.

The following special features are claimed for the No. 50-B blast hole drill: The frame, chassis and derrick are of all-steel construction with every piece hot riveted in its place; there is no wood to shrink, rot, wear out or burn; no danger from stray rock from a blast; no bolts in the frame to work loose or rust out.

In addition, the company states that all bearings are mounted on main sills, which keep the center of gravity low and prevent the machine from tipping easily. There are no superstructures or side draft.

Wire line derrick provides the only successful device for using wire cable exclusively, and it is estimated that it saves 75 per cent of the usual cable costs. Another feature permits the operator to reverse the rotation of any shaft on the machine at any time, which is a big saving of time and labor. The crown sheave, spudding sheave and heel sheave are all of the same diameter, thus eliminating short bends in the cable. The pull reel and sand-line reel have steel drums of large diameters and the sand-line brake is lined with asbestos.

The band wheel compensating clutch is an improved model and is guaranteed for life against breakage from any cause. The hoisting gear and pinion are of cast steel, while the axles, bolsters and wheels are of steel.

The gasoline engine-driven machine is equipped with reversing transmission, driving through alloy steel heat-treated gears and the electric motor-driven machine is equipped with machine-cut gears and noiseless fabric pinions.

The material and workmanship is said to be of the same high class as used in the manufacture of the most up-to-date machinery. The power is supplied by a four-cylinder Buda gasoline motor or an electric motor of standard make, at the option of the buyer.

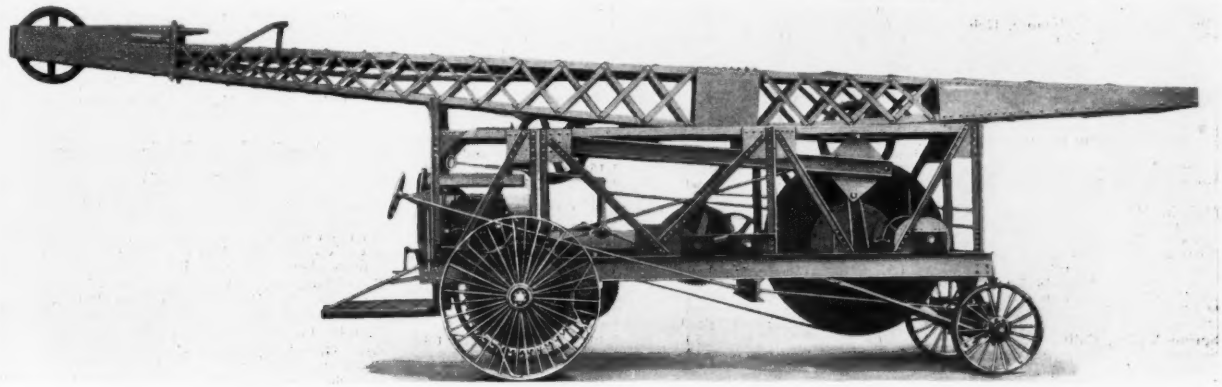
The company claims that because of the speed with which the machine will penetrate hard rock formations, and considering the low operating and maintenance cost, it will mean a big saving in the cost of drilling blast holes.

New Boiler Feed Pump

THE A. S. Cameron Steam Pump Works, New York, announces a new single-stage, turbine-driven, centrifugal boiler feed pump. The pump is designed for boiler plants having up to 2000 boiler horsepower and using steam pressures of 150 lb. or less.

The pump is of simple construction, having no valves or couplings. Its single-stage impeller and turbine rotor are mounted on the same shaft. The pump is fitted with horizontally-split casings and has but one gland on the turbine.

The company claims that the absence of a coupling and the compact design of the pump results in an unusually large capacity per unit of floor space required and that there is no pipe vibration.



This new model well drill of all-steel construction is equipped with gasoline engine or electric motor —at the option of the purchaser

The Rock Products Market

Wholesale Prices of Crushed Stone

Prices given are per ton, F. O. B., at producing plant or nearest shipping point

Crushed Limestone

City or shipping point	Screenings, ¼ inch down	½ inch and less	¾ inch and less	1½ inch and less	2½ inch and less	3 inch and larger
Blakeslee, N. Y.	1.00	1.25	1.10	1.10	1.10	
Buffalo, N. Y.	1.30 per net ton all sizes					
Chaumont, N. Y.	1.00		1.50	1.25	1.25	1.25
Cobleskill, N. Y.	1.25	1.25	1.25	1.25		
Coldwater, N. Y.	1.50 per net ton all sizes					
Eastern Penna.	1.35	1.35	1.35	1.35	1.35	1.35
Munns, N. Y.	1.00	1.25	1.25	1.25	1.25	
Prospect, N. Y.	.75	1.25	1.25	1.25	1.25	
Walford, Pa.		1.30	1.30	1.30	1.30	1.30
Western New York	.75	1.20	1.20	1.20	1.20	1.20
CENTRAL						
Alton, Ill.	1.50		1.50	1.35		
Buffalo, Iowa	1.00		1.35	1.15	1.20	1.20
Chasco, Ill.	1.30	1.25	1.25	1.25	1.20	
Chicago, Ill.	1.30	1.70	1.30	1.30	1.30	
Dundas, Ont.	1.00	1.00	1.35	1.25	1.10	1.10
Faribault, Minn.					1.75	
Greencastle, Ind.	1.25	1.10	1.00	.90	.90	.90
Krause, Columbia and Valmeyer, Ill.	1.00@1.30	1.00@1.30	1.00@1.30	1.00@1.30	1.00@1.30	1.30@1.50
Lannon, Wis.	.65		.95	.85	.85	.85
Mitchell, Ind.	.80	.80	.80	.80	.80	.80
Montreal, Canada	.80	1.35	1.05	.95	.90	
Montrose, Ia.		1.50	1.60	1.55	1.45	1.40
Sheboygan, Wis.	1.10	1.10	1.10	1.10	1.10	
Southern Illinois	1.35	1.40	1.35	1.30	1.25	
Stolle, Ill. (I. C. R. R.)	1.30		1.35	1.35	1.35	1.35
Stone City, Iowa	.75		1.40	1.30	1.25	
Toledo, Ohio	1.60	1.70	1.70	1.70	1.60	1.60
Toronto, Canada	1.90	2.25	2.25	2.25	2.00	2.00
Waukesha, Wis.	Prices include 90c freight All sizes 1.00 per ton					
SOUTHERN:						
Alderson, W. Va.	.75	1.25	1.40	1.25	1.15	
Bridgeport, Texas	1.25	1.40	1.40	1.40	1.25	1.25
Bromide, Okla.	.75			1.50	1.50	
Cartersville, Ga.		2.00	1.25	1.25	1.25	
Chickamauga, Tenn.	.80@1.00	.80@1.25		.80@1.00	.80@1.00	
El Paso, Tex.	1.00	1.00	1.00	1.00	1.00	
Ft. Springs, W. Va.	.75	1.25	1.40	1.25	1.20	
Garnet and Tulsa, Okla.	.50	1.60	1.60	1.45	1.45	
Ladds, Ga.			1.40	1.40	1.40	
Morris Spur (near Dallas) Tex.	1.00	1.40	1.40	1.40	1.40	1.25
WESTERN:						
Atchison, Kans.	.50	1.80	1.80	1.80	1.80	1.80
Blue Springs and Wymore, Neb.	.20	1.65	1.60	1.55	1.45	1.40
Cape Girardeau, Mo.	1.35		1.10	1.35	1.10	
Kansas City, Mo.	1.00	1.50	1.50	1.50	1.50	1.40

Crushed Trap Rock

City or shipping point	Screenings, ¼ inch down	½ inch and less	¾ inch and less	1½ inch and less	2½ inch and less	3 inch and larger
Branford, Conn.	.60	1.50	1.25	1.15	1.00	
Bound Brook, N. J.	1.80	2.30	1.90	1.50	1.40	
Dresser Jct., Wis.	1.00	2.25		1.75	2.00	
Duluth, Minn.	.90@1.00	2.25	1.90@2.00	1.40@1.50	1.25@1.40	
E. Summit, N. J.	2.30	2.50	2.20	1.90	1.60	
Eastern Massachusetts	.60	1.85	1.40	1.40	1.40	1.40
Eastern New York	.75	1.50	1.30	1.30	1.40	1.40
Eastern Pennsylvania	1.15	1.50	1.45	1.35	1.30	1.30
New Britain, Middlefield, Rocky Hill, Meriden, Conn.	.60	1.35@1.45	1.15@1.25	1.05	.95@1.00	
Oakland, Calif.	1.75	1.75	1.75	1.75	1.75	
Richmond, Calif.	.50*		1.50*	1.50*	1.50*	
Spring Valley, Calif.	.70	1.55	1.50	1.40	1.35	1.35
Springfield, N. J.	1.75	2.10	2.10	1.80	1.80	1.75
Westfield, Mass.	.60	1.35	1.25	1.10	1.00	

Miscellaneous Crushed Stone

City or shipping point	Screenings, ¼ inch down	½ inch and less	¾ inch and less	1½ inch and less	2½ inch and less	3 inch and larger
Buffalo, N. Y.—Granite	.90		1.20	1.00	1.05	1.10
Berlin, Utley and Red Granite, Wis.	1.50	1.60	1.40	1.30	1.30	
Columbia, S. C.—Granite	.50		2.00@2.50	2.00		1.75@2.00
Dundas, Ont.—Limestone	1.00	1.35	1.35	1.25	1.10	1.10
Eastern Penna.—Sandstone	.85	1.55	1.55	1.40	1.35	1.30
Eastern Penna.—Quartzite	1.20	1.30	1.20	1.20	1.20	1.20
Lithonia, Ga.—Granite	.90	1.75	1.75	1.40	1.40	1.00
Lohrville, Wis.—Cr. Granite	1.35	1.40	1.30		1.20	
Middlebrook, Mo.—Granite	3.00@4.00		2.25@2.50	2.00@2.25		1.50
San Diego, Calif.	.50@ .70	1.45@1.75	1.40@1.70	1.30@1.60	1.25@1.55	1.25@1.55
Sioux Falls, S. D.—Granite	1.00	1.60	1.55		1.50	

*Cubic yard. †Agrl. lime. ||R. R. ballast. ‡Flux. ‡Rip-rap, a 3-inch and less.

Agricultural Limestone

(Pulverized)

Chaumont, N. Y. — Analysis, 95% $CaCO_3$, 1.14% $MgCO_3$ — Thru 100 mesh; sacks, 4.00; bulk	2.50
Grove City, Pa. — Analysis 94.89% $CaCO_3$, 1.50% $MgCO_3$; 60% thru 100 mesh; 45% thru 200 mesh; sacks, 4.50; bulk	3.00
Hillsville, Pa. — Analysis, 96.25% $CaCO_3$; 75% thru 100 mesh; bulk	4.50
Jamesville, N. Y. — Analysis, 89.25% $CaCO_3$; 5.25% $MgCO_3$; 95% thru 50 mesh; bags, 4.00; bulk	2.50
New Castle, Pa.—89% $CaCO_3$, 1.4% $MgCO_3$—75% thru 100 mesh, 84% thru 50 mesh, 100% thru 10 mesh; sacks, 4.75; bulk	3.06
Walford, Pa.—Analysis, 50% thru 100 mesh; 4.50 in paper; bulk	3.00
West Stockbridge, Mass., Danbury, Conn., North Pownal, Vt.—Analysis, 90% $CaCO_3$—50% thru 100 mesh; paper bags, 4.25—cloth, 4.75; bulk	3.00
Alton, Ill.—Analysis, 97% $CaCO_3$, 0.1% $MgCO_3$; 90% thru 100 mesh	5.00
99% thru 200 mesh	8.00
Belleville, Ont. — Analysis, 90.9% $CaCO_3$, 1.15% $MgCO_3$—45% to 50% thru 100 mesh, 61% to 70% thru 50 mesh; bulk	2.50
Chasco, Ill.—Analysis 96.12% $CaCO_3$, 2.5% $MgCO_3$; 90% thru 100 mesh	5.00
Pulverized limestone	1.35
Detroit, Mich.—Analysis, 88% $CaCO_3$, 7% $MgCO_3$—75% thru 200 mesh, 2.50@4.75—60% thru 100 mesh	1.80@3.80
Marblehead, Ohio — Analysis, 83.54% $CaCO_3$, 14.92% $MgCO_3$; 60% thru 100 mesh; 70% thru 50 mesh; 100% thru 10 mesh; sacks	4.50
Bulk	3.00
Piqua, Ohio—70% thru 100 mesh; bags, 5.00; bulk	3.50
90% thru 100 mesh; bags, 7.00; bulk	5.50
Yellow Springs, Ohio—Analysis 96.08% $CaCO_3$, 63% $MgCO_3$; 32% thru 100 mesh; 95.57%, sacked, 6.00; bulk	4.25
Cape Girardeau, Mo.—Analysis, 93% $CaCO_3$, 3.5% $MgCO_3$; 50% thru 100 mesh	2.00
Hot Springs, N. C.—50% thru 100 mesh, sacks, 4.25; bulk	3.00
Knoxville, Tenn.—80% thru 100 mesh.	2.70
Bags	3.95
Mountville, Va. — Analysis, 76.60% $CaCO_3$, 22.83% $MgCO_3$—50% thru 100 mesh; 100% thru 20 mesh; sacks	5.00
Colton, Calif.—Analysis, 95% $CaCO_3$, 3% $MgCO_3$—all thru 20 mesh—bulk	4.00
Lemon Cove, Calif. — Analysis 94.8% $CaCO_3$, 0.42% $MgCO_3$; 60% thru 200 mesh; sacks, 5.25; bulk	4.50

Agricultural Limestone

(Crushed)

Alton Ill.—Analysis 97% $CaCO_3$, 0.1% $MgCO_3$; 90% thru 50 mesh	1.50
Bellevue, Ohio — Analysis, 61.56% $CaCO_3$, 36.24% $MgCO_3$; ¼ in. to dust, about 20% thru 100 mesh	1.2.
Bettendorf, Ia., and Moline, Ill.—97% $CaCO_3$, 2% $MgCO_3$—50% thru 100 mesh; 50% thru 4 mesh	1.50
Buffalo, Ia.—90% thru 4 mesh	1.00
Cape Girardeau, Mo. — Analysis, 93% $CaCO_3$, 3.3% $MgCO_3$—90% thru 50 mesh	1.50
90% thru 4 mesh, cu. yd.	1.35
Chicago, Ill.—Analysis, 53.63% $CaCO_3$, 37.51% $MgCO_3$—90% thru 4 mesh	1 00
Columbia, Ill., near East St. Louis—½-in. down	1.25@1.80
Elmhurst, Ill. — Analysis, 35.73% $CaCO_3$, 20.69% $MgCO_3$—50% thru 50 mesh	1.25
Huntington and Bluffton, Ind.—Analysis 61.56% $CaCO_3$, 36.24% $MgCO_3$; about 20% thru 100 mesh	1.25
Greencastle, Ind. — Analysis, 98% $CaCO_3$—50% thru 50 mesh	2.00
Kansas City, Mo.—50% thru 100 mesh	1.50
Krause and Columbia, Ill.—Analysis, 90% $CaCO_3$, 90% thru 4 mesh	1.20

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Agricultural Limestone

(Continued from preceding page.)

Latrobe, Wis.—Analysis 54% $CaCO_3$, 44% $MgCO_3$; 53% thru 10 mesh; 46% thru 60 mesh 2.00
Screenings (¼ in. to dust) 1.00
Marblehead, O.—Screenings, 40% thru 100 mesh 1.25
Milltown, Ind.—Analysis 94.41% $CaCO_3$, 2.95% $MgCO_3$; 33.6% thru 100 mesh, 40% thru 50 mesh ..... 1.25@1.65
Mitchell, Ind.—Analysis, 97.65% $CaCO_3$, 1.76% $MgCO_3$, pulverized limestone 1.50
Montrose, Ia.—90% thru 100 mesh 1.25
Narlo, Ohio—Analysis 56% $CaCO_3$, 43% $MgCO_3$, limestone screenings, 37% thru 100 mesh; 55% thru 50 mesh; 100% thru 4 mesh ..... 1.50@2.00
Ohio (different points), 20% thru 100 mesh; bulk ..... 1.25@1.50
River Rouge, Mich.—Analysis, 54% $CaCO_3$, 40% $MgCO_3$; bulk ..... .80@1.40
Stolle, Ill., near East St. Louis on I. C. R. R.—Thru ¼-in. mesh 1.30
Stone City, Ia.—Analysis, 98% $CaCO_3$ 50% thru 50 mesh ..... .75
Toledo, Ohio—¼-in. to dust, 20% thru 100 mesh 1.00
Waukesha, Wis.—No. 1 kiln dried 2.00
No. 2 Natural 1.75
Alderson, W. Virginia—Analysis 90% $CaCO_3$; 90% thru 50 mesh 1.75
Cape Girardeau, Mo.—Analysis, 93% $CaCO_3$, 3.5% $MgCO_3$ 2.00
90% thru 4 mesh 1.50
Cartersville, Ga.—Analysis 66% $CaCO_3$, 33% $MgCO_3$—all passing 10 mesh 1.75
Claremont, Va.—Analysis, 92% $CaCO_3$, 2% $MgCO_3$; 90% thru 50 mesh 3.00
50% thru 50 mesh; 90% thru 4 mesh; 50% thru 4 mesh 2.75
Ft. Springs, W. Va.—Analysis, 90% $CaCO_3$—90% thru 50 mesh 1.25
Ladds, Ga.—50% thru 50 mesh 2.00
Garnett, Okla.—Analysis, 80% $CaCO_3$, 3% $MgCO_3$; 50% thru 50 mesh ..... .50
Kansas City, Mo., Corrigan Sid'g—50% thru 100 mesh; bulk 1.80
Tulsa, Okla.—90% thru 4 mesh ..... .50

Miscellaneous Sands

Silica sand is quoted washed, dried and screened unless otherwise stated.

GLASS SAND:

Berkley Springs, W. Va. ..... 2.00@ 2.25
Cedarville and South Vineland, N. J.—Damp, 1.75; dry 2.25
Cheshire, Mass. ..... 5.00@10.00
Columbus, Ohio ..... 1.50@ 2.00
Dunbar, Pa. 2.50
Falls Creek, Pa. 2.25
Hancock, Md.—Damp, 1.50; dry 2.00
Klondike and Pacific, Mo. ..... 2.00@ 2.50
Mapleton, Pa.—Damp, 2.00; dry 2.75
Massillon, Ohio 3.00
Michigan City, Ind. ..... .50@ .55
Mineral Ridge, Ohio ..... 2.50@ 2.75
Green 2.00
Montoursville, Pa. 1.75
Oregon, Ill. ..... 1.50@ 2.00
Ottawa, Ill. 2.50
Pittsburgh, Pa.—Dry, 4.00; damp 3.00
Rockwood, Mich. 2.50
Round Top, Md.—Damp, 1.50; dry 2.00
Sands, Pa. 2.50
San Francisco, Cal. ..... 3.00@ 3.50
St. Mary's, Pa. 2.25
Thayers, Pa. ..... 2.00@ 2.50
Utica, Ill. ..... 1.25@ 1.50
Zanesville, Ohio ..... 2.00@ 2.50

FOUNDRY SAND:

Albany, N. Y.—Sand blast 3.75
Molding fine and brass molding 2.50
Molding coarse 1.75
Allentown, Pa.—Core and molding fine ..... 1.50@1.75
Arenzville, Ill.—Molding fine ..... 1.50@1.75
Brass molding 2.00
Beach City, O.—Core, washed and screened ..... 2.00@2.50
Furnace lining ..... 2.50@3.00
Molding fine and coarse ..... 2.25@2.50
Cheshire, Mass.—Furnace lining, molding, fine and coarse 5.00
Sand blast ..... 5.00@8.00
Stone sawing 6.00
Cleveland, O.—Molding coarse ..... 1.50@2.00
Brass molding ..... 1.50@2.00
Molding fine ..... 1.50@2.25
Core ..... 1.25@1.50
Columbus, Ohio—Core ..... .50@1.50
Sand blast ..... 3.50@5.00
Molding fine ..... 2.75@3.00
Molding coarse ..... 2.50@3.00
Brass molding ..... 2.50@3.00

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Wholesale Prices of Sand and Gravel

Prices given are per ton, F. O. B., at producing plant or nearest shipping point

Washed Sand and Gravel

City or shipping point	Fine Sand, 1/10 inch down	Sand, ¼ inch and less	Gravel, ½ inch and less	Gravel, 1 inch and less	Gravel, 1½ inch and less	Gravel, 2 inch and less
EASTERN:						
Ambridge and So. Heights, Pa.	1.15	1.15	1.15	1.15	.70	.70
Erie, Pa.		.60	.90		1.00	
Farmingdale, N. J.	.48	.48	1.00	1.00	1.20	
Hartford, Conn.	.90		1.25	1.15	1.15	1.15
Leeds Junction, Me.		.50	1.75	1.35	1.35	1.25
Machias, N. Y.	.75	.75	1.25	.85	.85	.85
Pittsburgh, Pa.	1.15	1.15	1.00	.70	.70	.70
Portland, Maine		.50	1.75		1.35	1.35
Washington, D. C. (rewashed, river)	.75	.75	1.60	1.40	1.20	1.20
CENTRAL:						
Alton, Ill.		.85				
Anson, Wis.	.50	.40				.90
Barton, Wis.	.60		.70	.70	.70	.70
Beloit, Wis.		.70			.80	
Chicago, Ill.		1.75@2.25	1.75@2.43			
Cincinnati, Ohio	.70	.65	.90	.90	.90	.90
Columbus, Ohio	.75	.75@1.25	.75@1.25	.75@1.25	.75@1.25	.75@1.25
Des Moines, Iowa	.60	.60	1.70	1.70	1.70	1.70
Earlestead (Flint), Mich.	.70		60-40 sieves, .85; Pebbles, .95			
Eau Claire, Wis.	40@ .50	.45	1.25			.90
Elkhart Lake, Wis.		.50			.60	.60
Ft. Dodge, Ia.		1.22		2.17		
Grand Rapids, Mich.		.50		.80		.70
Hamilton, Ohio		.90			.90	
Hawarden, Ia.		.50			1.60	
Hersey, Mich.	.40	.40			.70	
Indianapolis, Ind.	.60	.60		1.50	.75@1.00	.75@1.00
Janesville, Wis.		.65@ .75			.65@ .75	
Mason City, Ia.	.65	.60		1.80	1.70	1.65
Milwaukee, Wis.	1.06	1.06	1.26	1.26	1.26	
Minneapolis, Minn.	.35	.35	1.25@1.35	1.25@1.35	1.25	1.25
Moline, Ill.	.70	.70	1.40	1.40	1.40	1.40
Riton, Wis.		.60			.80	
St. Louis, Mo., f.o.b. cars	1.20	1.45	1.65	1.45		1.45
St. Louis, Mo., delivered on job	2.05	2.20	2.35	2.15		2.10
Summit Grove, Clinton, Ind.	.65@ .75	.60@ .75	.60@ .75	.60@ .75	.60@ .75	.60@ .75
Terre Haute, Ind.	1.00	1.00	1.25	1.25	1.00	1.00
Waukesha, Wis.	.40	.40	.80	.80	.80	.80
Winona, Minn.	.50	.40	1.25	1.25	1.25	1.25
Yorkville, Sheridan, Moronts, Oregon, Ill.	.60	.50@ .70		.60@ .80	.50@ .70	.60
SOUTHERN:						
Birmingham, Ala.	1.48		all gravel 1.88			
Charleston, W. Va.	all sand 1.40		all gravel 1.50			
Estill Springs, Tenn.	1.35	1.15		1.00	.85	.65
Ft. Worth, Tex.	1.50@2.00	1.50@2.00	1.50@2.00	1.50@2.00	1.50@2.00	1.50@2.00
Jackson's Lake, Ala.	.50@ .60	.50@ .60	.40@1.00	1.00	.50@1.00	.50@1.00
Knoxville, Tenn.	.75@1.00	1.00	1.00@1.50	1.00@1.50	1.00@1.50	1.00@1.50
Lake Weir, Fla.		.60				
Macon, Ga.		.50@ .75				
Memphis, Tenn.	1.12	1.12				1.95
N. Martinsville, W. Va.		1.00	1.00	1.00	1.00	.80
New Orleans, La.		.50			1.00	
Pine Bluff, Ark.	1.20	.90	Washed gravel, all sizes, 2.25			
Roseland, La.	.25			.85		
WESTERN:						
Grand Rapids, Wyo.	.50	.50	.85	.85	.80	.80
Kansas City, Mo.	(Kaw River sand, car lots, .75 per ton. Missouri River, .85)					
Los Angeles, Calif.		.70	1.20	1.20	1.10	1.10
Pueblo, Colo.	1.10*	.90*		1.25*		
San Diego, Calif.	.80@1.00	.80@1.00	1.30@1.60	1.25@1.55	1.15@1.45	1.15@1.45
San Francisco, Calif.		1.00	1.00@1.20	.85@1.00	.85@1.00	.85@1.00
Seattle, Wash.	1.00*	1.00*	1.00*	1.00*		1.00*
Spring Valley, Calif.	.70	.80	1.40	1.35	1.25	1.25

Bank Run Sand and Gravel

City or shipping point	Fine Sand, 1/10 inch	Sand, ¼ inch	Gravel, ½ inch	Gravel, 1 inch	Gravel, 1½ inch	Gravel, 2 inch
Boonville, N. Y.	.60@ .80		.55@ .75			1.00
Cape Girardeau, Mo.			River sand, 1.00 per yd.			
Cherokee, Iowa			.80 per ton—1.20 washed			
Dudley, Ky. (Crushed Sand)	1.00	1.00		.90		
East Hartford, Conn.			.65 per cu. yd.			
Elkhart Lake, Wis.	.70	.50			.60	.60
Estill Springs, Tenn.						.85
Fishers, N. Y.		.50@ .65		.50@ .65		
Grand Rapids, Mich.						.50
Hamilton, Ohio			.45 per cu. yd. in pit			
Hartford, Conn.		1.00*				
Hersey, Mich.				.50		
Indianapolis, Ind.			Mixed gravel for concrete work, .65			
Lindsay, Texas						.55
Janesville, Wis.		.65			.65@ .75	
Pine Bluff, Ark.			Road gravel .50			
Rochester, N. Y.	.60@ .75	.60@ .75			.50@ .65	.50@ .65
Roseland, La.		.75				
Saginaw, Mich., f.o.b. cars		.75	1.30	1.30	1.30	1.30
St. Louis, Mo.			60% gravel, 40% sand, 1.55			
Summit Grove, Ind.	.50	.50	.50	.50	.50	.50
Waco, Tex.		.80		1.50		1.30
Winona, Minn.			Clean pit run .60			
York, Pa.		.95@1.10	(crushed rock sand)			

*Cubic yard. B Bank. L Lake. || Ballast.

Crushed Slag

City or shipping point	Roofing	¼ inch down	½ inch and less	¾ inch and less	1¾ inch and less	2½ inch and less	3 inch and larger
EASTERN:							
Buffalo, N. Y.	2.35	1.35	1.35	1.35	1.35	1.35	1.35
E. Canaan, Conn.	4.00	1.00	2.50	1.35	1.25	1.25	1.25
Eastern Pennsylvania and Northern New Jersey	2.00	1.20	1.50	1.20	1.20	1.20	1.20
Easton, Pa.	2.00	.80	1.25	.90	.85	.80	.80
Erie, Pa.	2.35	1.35	1.35	1.35	1.35	1.35	1.35
Emporium, Pa.			1.35	1.35	1.35	1.35	1.35
Sharpsville and West Middlesex, Pa.	2.00	1.30	1.70	1.30	1.30	1.30	1.30
Western Pennsylvania	2.00	1.25	1.50	1.25	1.25	1.25	1.25
CENTRAL:							
Chicago, Ill.			All sizes, 1.50, F. O. B. Chicago				
Detroit, Mich.			All sizes, 1.65, F. O. B. Detroit				
Ironton, O.	2.05	1.45	1.80	1.45	1.45	1.45	1.45
Steubenville, O.	2.00	1.40	1.70	1.40	1.40	1.40	1.40
Toledo, O.	1.75	1.50	1.50	1.50	1.50	1.50	1.50
Youngstown, Dover, Hubbard, Leetonia, Struthers, O.	2.00	1.25	1.50	1.25	1.25	1.25	1.25
Steubenville, Lowellville and Canton, O.	2.00	1.35	1.60	1.35	1.35	1.35	1.35
SOUTHERN:							
Ashland, Ky.		1.55		1.55	1.55	1.55	1.55
Birmingham, Ala.	2.05	.80	1.25	1.15	1.10	.95	.85
Ensley, Ala.	2.05	.80	1.25	1.15	1.10	.95	.85
Longdale, Goshen, Glen Wilton & Low Moor, Roanoke, Va.	2.50	1.00	1.00	1.25	1.25	1.15	1.05

Lime Products (Carload Prices Per Ton F.O.B. Shipping Point)

	Finishing	Masons'	Agricultural	Chemical	Ground Burnt Lime		Lump Lime	
EASTERN	Hydrate	Hydrate	Hydrate	Hydrate	Blk.	Bags	Blk.	Bbl.
Adams, Mass.			7.00				2.90	
Bellefonte, Pa.		10.50§	10.50§	10.50§	9.00		8.50	1.80
Buffalo, N. Y.		12.00		12.00				
Berkley, R. I.			12.00					2.30
Chaumont, N. Y.					2.50	4.00		
Lime Ridge, Pa.							5.00	
West Rutland, Vt.	13.50	12.00		13.50			10.00	
West Stockbridge, Mass.								2.25
Williamsport, Pa.			10.00			10.00	6.00	
York, Pa. (dealers' prices)		10.50	10.50	12.50			8.50	1.65*
Zylonite, Mass.	3.20d	2.90d	7.00					
CENTRAL:								
Delaware, Ohio		10.00	9.50	10.50			9.00	1.60
Gibsonburg, Ohio					8.00			
Huntington, Ind.		10.00					9.00	
Luckey, Ohio	11.50	10.00	10 00					
Marblehead, Ohio		10.00	10.00				9.00	1.60
Marion, Ohio		10.00	10.00				9.00	
Mitchell, Ind.		12.00	12.00	12.00	11.00		10.00	1.60
Sheboygan, Wis.								7.50d
White Rock, Ohio	11.50				8.00	10.00		
Woodville, O. (dlrs.' price)	11.50a	10.00a	10.00a	11.00a			9.00	1.60
SOUTHERN:								
Erin, Tenn.							8.50	1.50
El Paso, Tex.							7.00	1.50
Karo, Va.							7.00	1.30
Knoxville, Tenn.	18.00	11.00@12.00		11.00@12.00	10.00	11.00	8.50	1.50
Ocala and Zuber, Fla.	12.00			12.00		12.00	12.00	1.60
Sherwood, Tenn.	12.50	11.00	11.00	11.00	8.50		8.50	1.50
Staunton, Va.					5.00	6.00	8.00	1.40
WESTERN:								
Colton, Calif.			15.00				19.70	
Kirtland, N. M.							12.50	
San Francisco, Calif.	22.00	22.00	15.00	22.00			16.00	2.15*
Tehachapi, Calif.							13.00	2.10

‡100-lb. sacks; *180-lb. net, price per barrel; †180-lb. net, non-returnable metal barrel; §Paper sacks. (a) 50-lb. paper bags; terms, 30 days net; 25c per ton or 5c per bbl. discount for cash in 10 days from date of invoice. (b) Burlap bags. (c) 200-lb. bbl. (d) 280-lb. bbl. net.

Miscellaneous Sands

(Continued from preceding page)

Delaware, N. J.—Molding fine	2.00
Molding coarse	1.90
Brass molding	2.15
Dresden, O.—Core and traction	1.00
Molding, fine and coarse	1.25
Brass molding	1.50
Dunbar, Pa.—Traction, damp	2.25
Dundee, O.—Glass, core, sand blast, traction	2.50
Molding fine, brass molding (plus 75c for winter loading)	2.00
Molding coarse (plus 75c for winter loading)	1.75
Eau Claire, Wis.—Core	1.00@1.25
Sand blast	3.10@3.60
Traction	.30@ .40
Falls Creek, Pa.—Molding, fine and coarse	1.75
Sand blast	2.00
Traction	1.75
Franklin, Pa.—Core	1.25@1.75
Furnace lining	2.50
Molding fine	2.00
Molding coarse	1.75
Brass molding	2.00
Greenville, Ill.—Molding coarse	1.75@2.00
Joliet, Ill.—Milled, dried and screened No. 2 coarse molding sand and open hearth loam and luting clay	.60@ .80
only)	.70
Kansas City, Mo.—Missouri River core	.80
Kasota, Minn.—Stone sawing	1.30@1.50
Klondike, Pacific, Gray Summit, Mo.—Glass sand, furnace lining, molding coarse	2.00@2.50
Molding fine	2.00
Mapleton, Pa.—Glass, core, furnace lining, molding fine and coarse; damp 2.00, dry	2.75
Massillon, O.—Traction, molding fine and coarse, furnace lining, core	2.75
Brass molding	3.00
Michigan City, Ind.—Core, traction	.40@ .45
Mineral Ridge, Ohio—(Green) core	2.00
Furnace lining, molding fine and coarse, roofing, sand blast, stone sawing and traction, brass molding	2.00
Montoursville, Pa.—Core	1.25@1.35
Traction	1.00
Molding fine	1.50
Molding coarse	1.50@2.00
New Lexington, O.—Molding fine	2.00
Molding coarse	1.75
(.75 extra per ton for winter loading)	
Oregon Ill.—Core, furnace lining	1.50@2.00
Sand blast	3.50
Stone sawing	3.50
Ottawa, Ill.—Core, furnace lining, molding, steel, traction, roofing sand	2.00
Brass molding	3.00
Sand blast	3.50
Stone sawing	3.50
Core and molding coarse (crude)	1.25@1.50
Ottawa, Minn.—All crude silica sand	.75@1.00
Pelzer, S. C.—Glass sand (carload lots	
Rockwood, Mich.—Core, damp	1.90
Roofing	2.75
Sand blast	3.75
Round Top, Md.—Glass sand	1.75@2.00
Core, furnace lining	1.45
Traction	1.60

(All per 2000 lbs.)

Miscellaneous Sands

(Continued)

San Francisco, Cal. (Washed and dried)—Core, molding fine, roofing sand and brass molding	3.00@3.50
Direct from pit.	
Furnace lining, molding coarse, sand blast	3.60
Stone sawing, traction	2.30
Thayers, Pa.—Core	2.00
Furnace lining	1.25
Molding fine and coarse	1.25
Traction	2.00
Utica Ill.—Core	1.00
Furnace lining	1.00
Molding fine	.85
Molding coarse	1.00
Stone sawing	1.00
Utica, Pa.—Core	1.25@2.25
Molding fine and coarse, traction, brass molding	2.00
Warwick, O.—Core, furnace lining, molding fine and coarse (damp, 1.75) dry	2.25
Traction, brass molding (dry)	2.00
Zanesville, Ohio—Core	2.00
Furnace lining	6.00
Molding fine	2.75
Molding coarse	2.50
Brass molding	3.00

Talc

Prices given are per ton f. o. b. (in carload lots only) producing plant, or nearest shipping point.

Baltimore, Md.—Ground talc (20-50 mesh), bags	10.00
Ground talc (150-200 mesh), bags	12.00
Cubes	50.00
Blanks (per lb.)	.07
Chatsworth, Ga., and Marshall, N. C.—Ground talc (150-200 mesh), bags	8.00@10.00
Chester, Vt.—Crude talc	5.00
Ground talc (150-200 mesh), bulk	6.50@ 8.50
Emeryville, N. Y.—200-325 mesh; bags	14.75
Glendale, Calif.—Ground talc (150-200-mesh)	16.00@30.00
(Bags extra)	
Ground talc (50-300 mesh)	13.50@15.50
200 mesh	13.50@14.50
Hailesboro, N. Y.—Ground talc (150-250 mesh), bags	18.00
Henry, Va.—Crude talc (lump mine run) per 2000-lb. ton	2.75@ 3.50
Ground talc (20-50 mesh), bags	8.75@10.00
(150-200 mesh), bags	9.75@12.50
Los Angeles, Calif.—Ground talc (200 mesh) (includ. bags)	16.00@20.00
Mertztown, Pa.—Ground talc (20-50 mesh); bulk 4.50, bags	5.50
(150-200 mesh); bulk 6.50, bags	7.50
Natural Bridge, N. Y.—Ground talc (150-200 mesh) bags	12.00@13.00
Rochester and East Granville, Vt.—Ground talc (20-50 mesh), bulk	8.50@10.00
(Bags extra)	
Ground talc (150-200 mesh), bulk	10.00@22.00
(Bags extra)	
Vermont—Ground talc (20-50 mesh); bags	7.50@10.00
Ground talc (150-200 mesh); bags	8.50@15.00
Waterbury, Vt.—Ground talc (20-50 mesh), bulk	7.50
(Bags 1.00 extra)	
Ground talc (150-200 mesh), bulk	9.00@14.00
(Bags 1.00 extra)	
Pencils and steel workers' crayons, per gross	1.20@ 2.00

Rock Phosphate

Raw Rock

Per 2240-lb. Ton

Centerville, Tenn—B.P.L. 72% to 75%	6.00@8.50
B.P.L. 65%	6.00
Gordonsburg, Tenn.—B.P.L. 68%-72%	4.50@5.00
Tennessee—F. o. b. mines, long tons, unground Tenn. brown rock, 72% B. P. L.	7.00
Mt. Pleasant, Tenn.—Analysis, .70 B.P.L. (2000 lbs.)	6.50
Paris, Idaho.—2,000 lb. mine run, B.P.L. 70%	3.60

(Continued on next page)

Roofing Slate

The following prices are per square (100 sq. ft.) for Pennsylvania Blue-Gray Roofing Slate, f. o. b. cars quarries:

Sizes	Genuine Bangor, Washington Big Bed, Franklin Big Bed	Genuine Albion	Slatington Small Bed	Genuine Bangor Ribbon
24x12	$10.20	$8.40	$8.10	$7.50
24x14	10.20	8.40	8.10	7.50
22x12	10.80	8.70	8.40	7.80
22x11	10.80	8.70	8.40	7.80
20x12	12.60	9.00	8.70	8.10
20x10	12.60	9.00	8.70	8.10
18x10	12.60	9.00	8.70	8.10
18x 9	12.60	9.00	8.70	8.10
16x10	12.60	8.70	8.40	7.80
16x 9	12.60	8.70	8.40	7.80
16x 8	12.60	8.70	8.40	7.80
18x12	12.60	9.00	8.70	8.10
16x12	12.60	8.70	8.40	7.80
14x10	11.10	8.40	8.10	7.50
14x 8	11.10	8.40	8.10	7.50
14x 7 to 12x6	9.30	8.10	7.50	7.50
	Mediums	Mediums	Mediums	Mediums
24x12	$ 8.10	$8.10	$7.20	$5.75
22x11	8.40	8.40	7.50	5.75
Other sizes	8.70	8.70	7.80	5.75

For less than carload lots of 20 squares or under, 10% additional charge will be made.

(Continued from preceding page)

Ground Rock

	Per 2000-lb. Ton
Wales, Tenn.—B.P.L. 70%	7.75
Barton, Fla. — Analysis, 50% to 65% B.P.L.	3.50@8.00
Centerville, Tenn.—B.P.L., 60-65%	5.00@6.00
B.P.L. 75% (brown rock)	12.00
Columbia, Tenn.—B.P.L. 68% to 72%	5.50
B.P.L. 65% (90% thru 200 mesh) bulk	5.50
Montpelier, Idaho — Analysis, 72% B.P.L., crushed and dried	3.75
Mt. Pleasant, Tenn.—B.P.L. 65%	5.50@6.00

Florida Soft Phosphate

Raw Land Pebble

	Per Ton
Bartow and Norwills, Fla.—B.P.L. 50%, bulk	6.00@ 8.00
B.P.L. 78%, bulk	13.50
Florida—F. o. b. mines, long ton, 68/66% B.P.L.	3.00
68% (min.)	3.25
70% (min.)	3.50
Jacksonville (Fla.) District	10.00@12.00

Ground Land Pebble

	Per Ton
Jacksonville (Fla.) District	14.00
Add 2.50 for sacks.	
Morristown, Fla.—26% phos. acid	16.00
Mt. Pleasant, Tenn.—65-70% B.P.L.	5.00@ 6.00

Special Aggregates

Prices are per ton f. o. b. quarry or nearest shipping point.

City or shipping point	Terrazzo	Stucco chips
Chicago, Ill.—Stucco chips, in sacks f.o.b quarries		17.50
Deerfield, Md. — Green; bulk	7.00	7.00
Easton, Pa.—Evergreen, creme green and royal green marble	20.00@22.00	16.00@20.00
Slate granules		7.00@ 7.50
Granville, N. Y. — Red slate granules		7.50
Ingomar, Ohio	10.00@12.00	10.00@25.00
Lincoln, Neb. — Red, white, grey, in bags		30.00
granite; sacks	28.50@30.00	20.00@22.50
Marble chips, white, pink, creole, black		27.50
green		37.50
sparklets		50.00
(bags extra)		
Milwaukee, Wis.		20.00@30.00
New York, N. Y.—Red and yellow Verona		32.00
Middlebrook, Mo.—Red		25.00@30.00
Phillipsb'g, N. J.—Green stucco dash	20.00@22.00	16.00@20.00
Piqua, O.—Marble		7.00@ 9.00
Poultney, Vt. — Roofing granules		7.50
Red Granite, Wis.		7.50
Sioux Falls, S. D.	7.50	7.50
Tuckahoe, N. Y.		10.00@14.00
Whitestone, Ga.—White marble chips, net ton in bulk, f.o.b., bags		
15c extra	5.00	5.00

Concrete Brick

Prices given per 1,000 brick, f. o. b. plant or nearest shipping point.

	Common	Face
Appleton, Minn.	16@18.00	25.00@32.50
Birmingham, Ala.	15.00	30.00
Carpenterville, N. J.	20.00	36.00
Easton, Pa.	16.00	40.00@60.00
Eugene, Ore.	25.00@26.00	50.00@75.00
Friesland, Wis.	20.00	32.00
Houston, Tex.		19.50
Omaha, Neb.	18.00	30.00@40.00
Portland, Ore. (Del'd)	21.00	45.00@60.00
Puyallup, Wash.	20.00	30.00@75.00
Rapid City, S. D.	18.00	25.00@40.00
St. Paul, Minn.	15.00	30.00@35.00
Salem, Ore.	25.00	35.00@50.00
Salt Lake City, Utah	17.00@18.00	35.00@40.00
Seattle, Wash.	22.00	35.00@80.00
Springfield, Ill.	18.00	29.00@25.00
Tampa, Fla.	15.00	25.00@65.00
Wauwatosa, Wis.	13.00@14.00	27.00@65.00
Winnipeg, Can.	18.00	26.00

Sand-Lime Brick

Prices given per 1,000 brick f. o. b. plant or nearest shipping point, unless otherwise noted.

Barton, Wis.	10.50
Boston, Mass.	13.00@14.00
Buffalo, N. Y.	16.50
Dayton, Ohio	12.50@13.50
El Paso, Texas	12.00
Grand Rapids, Mich.	11.50
Lancaster, N. Y.	13.50
Michigan City, Ind.	11.00
Milwaukee, Wis. (delivered)	14.00
Minneapolis, Minn.	13.00
Plant City, Fla.	10.00
Portage, Wis.	15.00
Redfield, Mass.	15.00
Rives Junction, Mich.	11.00
Saginaw, Mich.	11.00
San Antonio, Texas—Common	15.00
South Dayton, Ohio	12.50@13.50
Syracuse, N. Y. (delivered at job)	18.00
f.o.b. cars	14.00
Washington, D. C.	14.50

Lime

Warehouse prices, carload lots at principal cities.

	Hydrate per Ton	
	Finishing	Common
Atlanta, Ga.	23.00	13.00
Baltimore, Md.	21.00	15.75
Cincinnati, Ohio	14.80	12.30
Chicago, Ill.	20.00	18.00
Dallas, Tex.	25.00	.....
Denver, Colo.	24.00	.....
Detroit, Mich.	18.00	13.25
Kansas City, Mo.	25.60	24.00
Minneapolis, Minn. (white)	25.50	22.00
Montreal, Que.	21.00	21.00
New Orleans, La.	.....	17.25
New York, N. Y.	16.80	13.10
Philadelphia, Pa.	15.50	14.50
St. Louis, Mo.	21.20	19.00
San Francisco, Calif.	22.00	16.00
Seattle, Wash. (paper sacks)	24.00	.....
	Lump per 180-lb. Barrel (net)	
	Finishing	Common
Atlanta, Ga.	2.25†	1.85†
Baltimore, Md.	.....	15.00‡
Cincinnati, Ohio	.....	10.75‡
Chicago, Ill.	1.50†	1.40†
Dallas, Tex.	15.00‡	11.00‡
Denver, Colo.	.....	2.70†
Detroit, Mich.	.....	17.00‡
Kansas City, Mo.	2.34†	2.20†
Minneapolis, Minn.	1.70†	1.40†
Montreal	15.00‡	11.00‡
New Orleans, La.	2.40†	.....
New York, N. Y.	3.63½*	2.75@3.13½*
Philadelphia, Pa.	13.00‡	12.00‡
St. Louis, Mo.	.....	17.75‡
San Francisco, Calif.	.....	1.75†
Seattle, Wash.	2.80†	.....

*Per 280 lb. bbl. (net). †Per 180-lb. bbl. (net). ‡Per ton. Refund of 10c per bbl. Minneapolis quotes brown common lump lime: Kelly Island white is $1.55, Sheboygan $1.45. New York quotes hydrated lime "on cars" in paper sacks; lump lime "alongside dealers' docks" or "on cars."

Portland Cement

Current prices per barrel in carload lots, f. o. b. cars, without bags.

Atlanta, Ga.	2.80
Boston, Mass.	3.03
Cedar Rapids, Iowa	2.45
Cincinnati, Ohio	2.51
Cleveland, Ohio	2.46
Chicago, Ill.	2.20
Dallas, Tex.	2.25
Davenport, Iowa	2.43
Denver, Colo.	2.65
Detroit, Mich.	2.47
Duluth, Minn.	2.14
Indianapolis, Ind.	2.41
Kansas City, Mo.	2.45
Los Angeles, Calif.	3.00
Milwaukee, Wis.	2.37
Minneapolis, Minn.	2.39
Montreal, Can. (sacks 20c extra)	2.40
New Orleans, La.	2.83
New York, N. Y.	2.70
Pittsburgh, Pa.	2.24
Portland, Ore.	3.05
St. Louis, Mo.	2.35
St. Paul, Minn.	2.39
Toledo, Ohio	2.48
Seattle, Wash.	2.90

NOTE—Add 40c per bbl. for bags.

Gypsum Products— CARLOAD PRICES PER TON AND PER M SQUARE FEET, F. O. B. MILL

	Crushed Rock	Ground Gypsum	Agricultural Gypsum	Stucco* Calcined Gypsum	Cement‡ and Gauging Plaster	Wood Fiber	White§ Gauging	Sanded Plaster	Keene's Cement	Trowel Finish	—Plaster Board— ¼x32x36" Weight 1500 lb. Per M Sq. Ft.	⅜x32x36" Weight 1850 lb. Per M Sq. Ft.	Wallboard, ⅜x32 or 48" Lengths 6'-10', 1850 lb. Per M Sq. Ft.
Douglas, Ariz.	.....	.....	5.00	7.50	8.50	.....	.....	.....	.....	.....	.....	.....	.....
Fort Dodge, Iowa	3.00	3.50	6.00	8.00	10.00	10.50	20.00	.....	21.30	20.00	20.00	.....	30.00
Garbutt, N. Y.	.....	.....	6.00	8.00	10.00	10.00	.....	7.00	.....	.....	.....	20.00	.....
Grand Rapids, Mich.	3.00	.....	7.00	10.00	10.00	10.00	.....	.....	31.05	.....	20.00	21.00	30.00
Hanover, Mont.	4.50	.....	6.00	10.00	.....	10.50	.....	.....	.....	.....	.....	.....	.....
Mound House, Nev.	.....	8.50	6.50	10.50@11.50	.....	.....	.....	.....	.....	.....	.....	.....	.....
Oakfield, N. Y.	3.00	4.00	6.00	8.00	10.00	10.00	20.20	7.00+	30.75	21.00	19.375	20.00	30.00
Rapid City, S. D.	4.00	.....	.....	10.00	12.00	12.50	.....	.....	33.75	.....	.....	.....	.....
Winnipeg, Man.	5.50	5.50	7.00	13.50	15.00	15.00	.....	.....	.....	.....	28.50	.....	35.00

NOTE—Returnable Jute Bags, 15c each, $3.00 per ton; Paper Bags, $1.00 per ton extra.
*Shipment in bulk 25c per ton less; ‡Bond plaster $1.50 per ton additional; +Sanded Wood Fiber $2.50 per ton additional; §White Moulding 50c per ton additional; ||Bulk; (a) Includes sacks.

Accident Prevention

An Important Aid to Construction—III

By R. C. Marshall, Jr.
General Manager, Associated General Contractors of America

IF a census of construction companies were taken to ascertain the attitude concerning safety work, we should doubtless find that it is almost universally approved. Yet a great many companies have not undertaken the work. The difficulty, as already mentioned, is that they are not familiar with the means of carrying on this activity. They need further explanation of the subject and some standard concise procedure for making investigations and interpreting the result. The National Safety Council provides the means through which contractors can learn and apply proper methods of accident prevention, but the standardization of safety work is yet to be carried out for the construction industry. In this work the assistance of every construction company is merited.

What the Council Is Doing

The Council is already rendering service which includes the following features:

(a) A clearing house for the exchange of safety methods, which affords distribution of approved practices to the various industries and to individuals in the same industry. The Construction Section carries on this work especially for contractors, by means of literature and posters explaining methods and devices applying to different classes of accidents.

(b) Special investigations and original research, which are finding new methods of prevention and devising systematic means of recording accidents, so that they may be controlled as a concrete factor in production. Some 50 or 60 pamphlets, the result of special investigation, which treat of specific measures of safety work, a number of which are applicable in part to construction, have been distributed.

(c) A comprehensive information service which furnishes posters, job bulletins, descriptions of devices and emergency measures together with news reports of the progress of safety work in many industries. Through these, some of which apply in part to construction and some of which are especially devoted to construction, contractors are able to gain information for conducting effective safety work.

The Construction Section

The Construction Section, which has a membership of something over 200 companies, has done valuable work and should be expanded in both service and membership; but until the membership is increased the service cannot be extended to cover adequately the four or five major divisions of the industry.

Many special hazards are encountered in construction which should be called to the attention of superintendents and workmen by means of proper literature, job signs, and illustrated posters. Moreover, each division of construction has its own peculiar hazards which need special investigations and presentation to the working force. These needs are understood by the officers of the Construction Section who have given a great amount of personal time to the work, but they cannot carry out the necessary service without additional support from those who are to derive the benefit. Every member of the Construction Section should act as a personal solicitor for membership, thus helping to provide the means for carrying on the work.

First Step Advised

In view of the size of the construction industry and the special nature of its safety problems, one of the first steps that appear advisable from the contractor's viewpoint is the appointment of a special secretary or safety engineer to conduct the work of this section. Such a man could assist the Associated General Contractors and other organizations in promoting safety, and could direct the special investigations that are needed. By this means the effectiveness of the work could be increased many fold among contractors. The secretaries of contractors' organizations are comparatively new in this field of work and could work much more efficiently with the advice and assistance of a special secretary or engineer in the construction section of the Council. The A. G. C. desires to increase its co-operation with the Council. So far, however, it has lacked the contact of someone whose time could be devoted to co-ordinating the work. Obviously the officers of the section cannot perform this function in addition to their other duties. The Associated General Contractors and other contractors' organizations can give effective aid in preparing the ground for more intensive membership work, and through their publications can point out the effectiveness of applying educational methods to the working force. The A. G. C. stands ready to co-operate in any manner possible, but it believes the most effective co-operation can be offered through the direct contact of a safety engineer for the Construction Section.

(Concluded)

Neatness Promotes Safety

STEADY employes are the best men to have around a plant, from an operating standpoint, and, everything else being equal, they are less likely to be injured.

A well-kept plant and pleasant living accommodations go a long way toward stabilizing organization. And besides, the clean and orderly plant has the fewest accidents—they have the best men.

News of All the Industry

Incorporations

The **Verter and Groves Sand Co.**, Edwardsville, Kans., has been incorporated for $50,000.

The **Southeastern Gypsum Co.**, an Arizona organization, has been incorporated for $100,000.

The **Verter and Groves Sand Co.**, Edwardsville, Kans., has been incorporated for $50,000.

The **Ohio Portland Cement Co.**, Wilmington, Del., has been incorporated for $3,000,000 to manufacture portland cement.

The **International Gypsum Corp.**, Seattle, Wash., has been incorporated for $60,000 by D. McMasters and others.

The **Albany Gravel Co.**, Albany, N. Y., has been incorporated for $50,000 by C. W. Maxwell, G. K. Smith and W. Green.

The **Seymour Sand and Stone Co.**, Seymour, Conn., has been incorporated for $100,000 by W. A. Gabler, Oxford, and others.

The **Kaukauna Quarry Co.**, Kaukauna, Wis., has been incorporated for $15,000 by J. P. Frank, H. B. Peekey and Elsie Koffend.

The **Patterson Glass Co.**, Henryetta, Kans., has been incorporated for $25,000 by A. F. Patterson, H. B. Welp and John Donnehy.

The **Nassau Brick Sales Corp.**, Brooklyn, N. Y., has been incorporated for $10,000 by C. A. Wachter, M. C. Ramirez and C. E. Cowhill.

The **Illinois Glass Co.**, Alton, Ill., has been reorganized with a capital stock of $11,100,000 by J. M. Levis, E. M. Ashcraft and C. J. Lord.

The **Newburgh Lime Manufacturing Co.**, Newburgh, N. Y., has been incorporated for $20,000 by W. C. Martin, A. Lecheman and M. Gorchoff.

The **Tell City Sand and Gravel Co.**, Tell City, Ind., has been incorporated for $40,000 by E. T. Slider, O. G. Reilly, W. Slider, C. Herr and L. Herr.

The **Hall-Spiers Brick Co.**, Berlin, Conn., has been incorporated for $75,000 to manufacture brick. Incorporators are F. M. Hall, W. A. Spear and P. H. Spear.

The **Woodstock Slag Co.**, Birmingham, Ala., has been incorporated for $50,000 by G. A. Matteson, president; C. Jones, vice president and treasurer; G. A. Matteson, Jr., secretary.

The **Concrete Ingredients Corp.**, Albany, N. Y., has been incorporated for $500,000 by F. A. Eldredge and others. The company will operate its sand and gravel pits by hydraulic system.

Sand and Gravel

The **Victoria Sand and Gravel Co.**, Victoria, Tex., has under construction its plant near here.

The **Evansville Sand and Gravel Co.'s** plant at Mt. Vernon, Ind., has been closed down for the season.

The **Ohio River Gravel Co.**, Parkersburg, W. Va., is the successor to the Parkersburg Sand Co.

The **Yahola Sand and Gravel Co.**, Yahola, Okla., is making improvements at its plant which will increase its capacity to 100 to 150 cars a day.

The **Monroe Sand and Gravel Co.**, Monroe, La., has been incorporated for $25,000 by T. B. Stephenson, Monroe, president; J. A. Stephenson, Shreveport, vice-president, and R. O. Randle, Monroe, secretary-treasurer.

Cassopolis, Mich.—Grover Kimmerle is installing his mining outfit at the Benson gravel mine to furnish 25,000 yards of gravel for the cement work on the road construction between Uniontown and Mattville, which the state will build the coming year.

Grass Valley, Calif.—Gravel is coming from the drifts of the Malakoff Leasing Co., North Bloomfield. Operations are through a shaft about 270 ft. in depth. Drifts are being run completely under the channel and the gravel stopped through upraises.

The **Stillwell Sand and Gravel Co.**, Anderson, Ind., purchased the equipment of C. M. Kirckpatrick, road-building contractor, for approximately $50,000. The company also bought 25 motor trucks to be used in road building. The company has a contract for the state highway between Indianapolis and the Howard county line.

The National Silica Manufacturing Co., Kansas City, Kans., will erect a silica refining plant in the Armourdale district at a cost of $100,000. The plant will cover an acre and will have modern storage facilities and a refinery and the majority of machinery will be operated by electricity. M. P. Garlow, Meade, is president; G. J. Gillman, treasurer and O. Q. Claffen, Jr., secretary.

Lime

The **Palmer Lime and Cement Co.**, Stickley Quarry, Va., announces the installation of a York kiln.

Baker, Ore.—It is planned to develop the great lime deposits on Snake river, and there is now under consideration the erection of a $500,000 cement plant in the West for the manufacture of portland cement.

The Western Lime and Cement Co., Milwaukee, Wis., has purchased frontage on Fox river at Green Bay, Wis., as the site of a new dock, reduction plant and distributing warehouse, including kilns for preparing limestone for paper mills as well as construction purposes. The investment will represent $500,000.

The Bessemer Limestone and Cement Co., Youngstown, O., during the first 10½ months of the year shipped 1,000,000 bbl. of cement from its Bessemer, Pa., plant, which has a rated yearly capacity of that amount. The company is erecting additional storage facilities to meet spring demand with a larger reserve.

Rockland, Me.—Several lime kilns in this and neighboring towns have been burning wood again, owing to the coal shortage. The Edward Bryant Co., Rockland and Rockport, has been burning wood purchased in New Brunswick. Small shipments of coal have been arriving, however, and it is probable that coal burning will be resumed within a few months.

Concrete Products

The **Colonial Concrete Products Co.**, Baltimore, Md., has let the contract for building an addition to its plant.

The **Oliver Springs Brick Co.**, Oliver Springs, Tenn., has filed an amendment increasing its capital from $60,000 to $75,000.

The **Concrete Arch Co.**, Manhattan, N. Y., has been incorporated for $10,000 by C. E. Miller, R. Barzone and F. W. Miller.

The Northwest Davenport Cement Block Co., Davenport, Ia., will build a new plant next spring. F. Meir is manager.

Dr. J. J. Briggs, Indianapolis, Ind., has let the contract for the erection of a factory building in Seymour, Ind., for the purpose of manufacturing stucco.

The Dixie Brick and Tile Co., Puryear, Tenn., has applied for an amendment to its charter increasing its capital stock from $20,000 to $100,000. The application was made by O. A. Harker, Jr., M. B. Harker and R. W. Barton.

The Cape Fear Gravel Co., Lillington, N. C., has been incorporated and will develop gravel pits and manufacture concrete products. The company will construct a plant at Cape Fear and has plans for another plant west of Lillington. C. W. Lacy is president and T. H. Higgs, general manager.

Personal

Kirby Thomas, well-known consulting engineer of New York, paid a visit to Rock Products on December 22. Mr. Kirby was on his way West to visit some mining properties.

Obituary

Fred A. Marsh, general purchasing agent of the Link-Belt Co., died suddenly at his home, 6436 Greenwood avenue, Chicago, on December 11 at the age of 52 years. Mr. Marsh was a member of this organization for more than 33 years; was one of the organizers of the Purchasing Agents' Association of Chicago, and served as its first president; and was for years a director in the National Association of Purchasing Agents. He will be remembered by a large circle of business acquaintances as a particular well informed man in his line, of sterling character, absolutely impartial in his treatment of sellers, buying on merit, and an honor to his business profession.

Trade Literature

Truck Dump Bodies.—A seven-page folder has recently been issued by the Mandt Co., Keokuk, Iowa, in which the company illustrates and describes its entire line of dump bodies for motor trucks.

Crane Excavators.—A folder has recently been issued by the Koehring Co., Milwaukee, Wis., illustrating its No. 3 crane. The folder is complete with specifications and data covering this machine. At the same time, the company issued a similar folder covering its No. 2 crane.

Dryers.—The Ruggles-Coles Engineering Co., New York, has just published a four-page bulletin covering the operation principles of some of its various types of dryers. The bulletin contains several reproduced photographs showing installations of the dryers in different kinds of plants, and it is provided with sectional views and diagrams.

Portable Loaders.—The Link-Belt Co., Philadelphia, Pa., has just issued catalog No. 550 on its entire line of portable equipment. The book contains specifications of the company's one-man power swiveling loader, the portable belt conveyor and its "C S" loader for handling sand and gravel. In addition to specifications, the book is profusely illustrated in operation.

Gears.—In order to acquaint the industrial gear user with the advantages of Micarta gears, the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., has issued a 20-page booklet, Folder 4506, entitled "Salient Facts on Silent Gears." The booklet describes the advantages of the use of Micarta gears and pinions and gives photographs and data describing some of their applications, tables of gear data, etc., enabling the gear user to judge whether they are applicable to his machinery.

Quarry Machinery.—"Mining, Quarry and Gravel Pit Machinery" is the title given a booklet recently sent out by the Smith Engineering Works, Milwaukee, Wis. The company announces many improvements made in its various machines and gives data covering them. The booklet shows the different types of crushers, washers, screens, tanks, conveyors, elevators, line gates and feeders. The company announces the early issuance of a new bulletin, No. 261, now in preparation.

Gear Speed Reducer catalog No. 26 issued by the W. A. Jones Foundry & Machine Co., Chicago, is now ready for distribution. The information contained in the catalog is of value to consulting engineers, superintendents, master mechanics and anyone who specifies mechanical drive for factories, mills, mines, or plants. The company wishes to place copies of the edition in the hands of all those interested in speed reduction problems, and asks that requests for copies be made on business stationery to facilitate prompt delivery.

The Portland Cement Association has recently issued a 15-page booklet, "Portland Cement Stucco." The booklet was prepared especially for architects and builders and contains instructions for the use and application of stucco, as well as drawings of construction details and views of modern stucco homes and buildings. On the back cover the association extends an invitation to all users of cement to call on the association's engineers for any information on the use of cement. This information, as well as educational booklets and pamphlets, is free and may be obtained by writing the association's Chicago office at 111 West Washington street.

A "FORD" in the Pump Field

For Low Cost and Big Capacity You Can't Beat the EVINRUDE

ANY man who has ever owned an Evinrude Centrifugal Pump will back up that statement, regardless of the use he has made of it. For there's not another pump on the market with a capacity of 5,000 gallons at a 20-foot head that costs so little to operate and is so reasonably priced.

Light and compact, the Evinrude is the handiest, most adaptable pumping outfit made. Weighing only 115 pounds, it is easily moved by two men. Occupying a space only 16"x23", it may be lowered into ditch, caisson or excavation and submerged in the water. A 2 H. P. built-in, gasoline engine, the very one now used in 150,000 Evinrude rowboat motors, supplies the power. No need for any "installation." An Evinrude may be used with or without a suction line.

Every day someone discovers a new use for this powerful little pump. Sewer contractors find it a life-saver for working in close quarters. Road-builders use it for supplying water to their mixers in cases of emergency. After a rain, it is the contractor's best friend for clearing the water out of his building excavations.

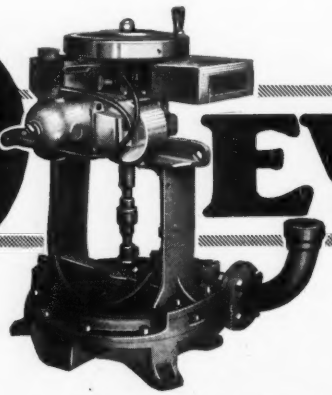
Many Evinrudes are used in quarries, gravel pits and mines to dispose of drainage water. Bridge builders find them very efficient for emptying coffer dams. Street railway and public service companies buy them for their underground work. Because of its quick action and compactness the Evinrude is an ideal priming pump for the larger centrifugal pumps with which sand dredges are equipped.

If you have a pumping problem, requiring a small outfit of the Evinrude capacity, write for our literature describing and illustrating the many ways in which this pump is now serving.

Dealers: Write for our proposition. Some very desirable territory is still available

EVINRUDE MOTOR COMPANY
23 Lake Street **Milwaukee, Wis.**

5000 GALLONS per hour at 20 ft. head



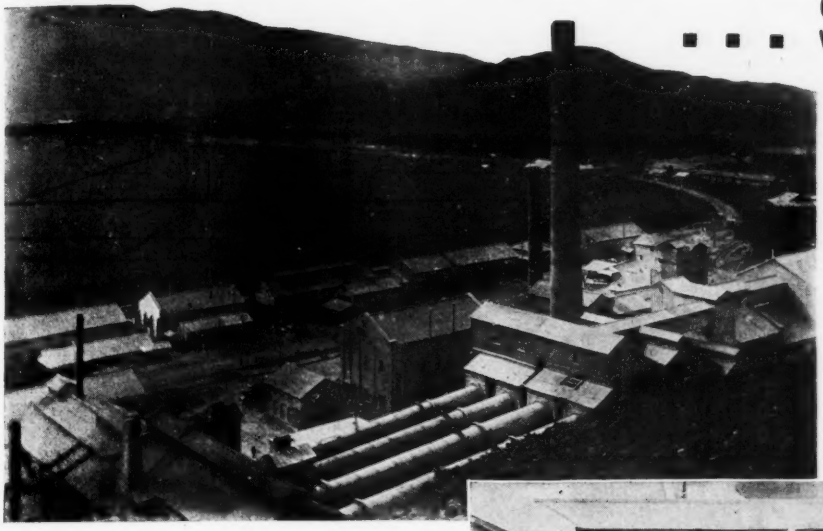
EVINRUDE CENTRIFUGAL PUMP

Exhibited at Road Show, Chicago

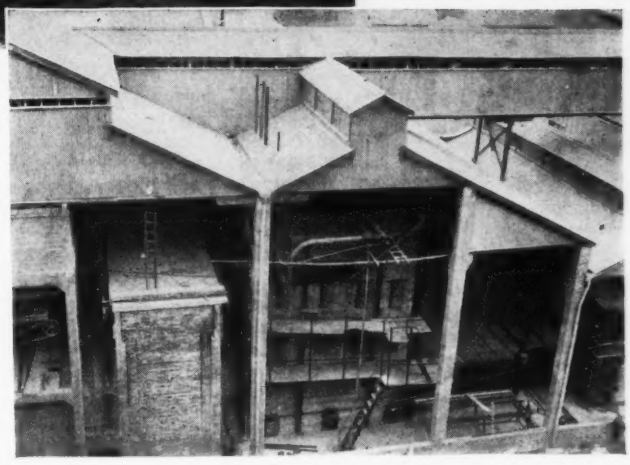
For users requiring a more powerful pump the Evinrude No. 1½ is recommended; 7400 gallons per hour at a 20-foot head—3½ H.P. Evinrude motor. Price $175.00.

Price: $150.00 F.O.B. MILWAUKEE

350 lbs. Steam from Each 100 lbs. Coal ... SAVED



Plant of Hokoku Cement Company, Karita, Japan, equipped with Edge Moor Waste Heat System consisting of two 747 H. P. boilers and special auxiliary equipment.



Partial view of Edge Moor Waste Heat System at Hokoku plant, showing flue, boiler and economizer.

HERE'S a concrete example of the savings effected by the EDGE MOOR WASTE HEAT SYSTEM:

In an efficiently operated dry-process kiln, burning 13,500 B. T. U. coal, about 1400 lbs. of gas are produced per 100 lbs. of coal burned. The temperature of this gas when it leaves the kiln is about 1500 degs. F.

To reduce the gas temperature from 1500 degs. F. to 350 degs. F. with an allowance of 40% air leakage and mean specific heat of gas at 0.26, means the recovery of about 379,000 B. T. U. for each 100 lbs. of coal burned—over 28% of the original B. T. U. content, otherwise absolutely wasted.

Under average conditions, this heat recovery per 100 lbs. of coal will yield 350 lbs. of steam —at no additional cost for fuel.

Usually, the waste heat recovered by the Edge Moor System is sufficient to carry the entire power load of the plant. Savings of 30% to 40% of the total fuel consumption of the plant have been realized by the installation of waste heat equipment and the shutting down of direct fired boiler plants. As a result, the waste heat system pays for itself in one to two years.

Details of design and construction, with further figures of economies effected, are contained in the Edge Moor catalogue. Tell us where to send your copy.

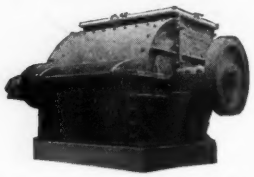
EDGE MOOR IRON COMPANY

New York Chicago St. Paul — *Established 1868* — EDGE MOOR, DELAWARE — *Boston Pittsburgh Charlotte*

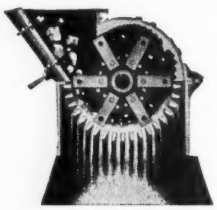
EDGE MOOR Water Tube BOILERS

FOR INCREASED FUEL ECONOMY

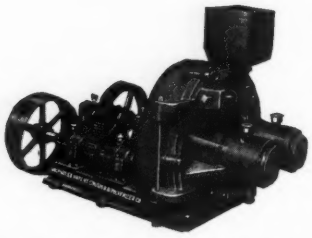
When writing advertisers please mention ROCK PRODUCTS



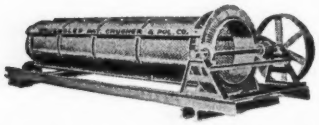
Above is one of the monster Gruendler Swing Hammer Crushers—capacity 200 tons per hour. This crusher has replaced as many as 3 secondary crushers in many plants throughout the country.



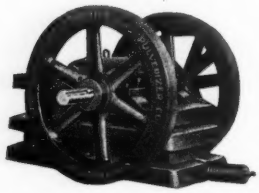
The illustration above shows interior view of the Gruendler Swing Hammer Pulverizer, belt or motor driven. Grinds medium fine preliminary to tube mill or breaking down. With or without automatic feeder.



The Gruendler Roller Mill shown above is for fine grinding of hard materials—comes in 4 sizes.



The illustration shown above is that of the powerful Gruendler Revolving Screen Roller type. All sizes—perforated plates or wire cloth—with dust jacket or housing if desired.



The Gruendler Jaw Crusher shown is especially adapted for preliminary crushing of all hard materials. Semi-steel throughout.

GRUENDLER Crushers

Have Greatest Capacity

Gruendler Crushers and Pulverizers are specially constructed to stand heavy stresses and strains. They handle oversize rock, shale or clay ***just as it comes from the quarry,*** reducing 36″ rock to 1½″ ***in one operation.*** They assure greatest capacity and an entirely uniform product, often replacing as many as three dry pans in Brick and Tile Plants, and from 2 to 4 Jaw or Gyratory Crushers in Quarries and Cement Plants. Crushers made to handle 3 tons to 5000 tons daily—also Roller Mills and Pulverizers with air separation, and direct or indirect dryers.

Operate at a Saving

Ball-bearing or ring-oiling throughout, Gruendler Crushers and Pulverizers start under full load —can't be overloaded—and operate at a big saving in horse-power. Fewer parts and fool-proof construction insure minimum upkeep.

Free Trial

Write for details of our FREE TRIAL offer and learn about the absolute 2-year guarantee against defects in workmanship and material. Ask for Rock Crusher Circular.

Gruendler Patent Crusher & Pulverizer Co.

Main Office and Works:

908 North Main St., St. Louis, Mo.

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For Steady Digging in Close Quarters

Duluth, Minn.,
Dec. 30th, 1922.

Mr. Mine and Quarry Operator.

Gentlemen:

After visiting a number of Limestone, Talc, Gypsum, Feldspar, and Phosphate mines throughout the country, and an equal number of open pit operations producing different materials from rock to fine sand, we have reached the conclusion that this firm has a vital message for each one of you.

In nearly every plant visited it was found that although the power plants, mills, hoisting and haulage systems had been erected with the best ideas for economy—they were still loading their product by hand. In those operations where there was the room to operate, sufficient tonnage being at hand, a large steam shovel was at work. The natural and correct thing to install.

But in those operations where the working space was congested and they were only blasting down a few hundred tons a shift, most people were depending on Ellis Island & Co. to load their muck cars.

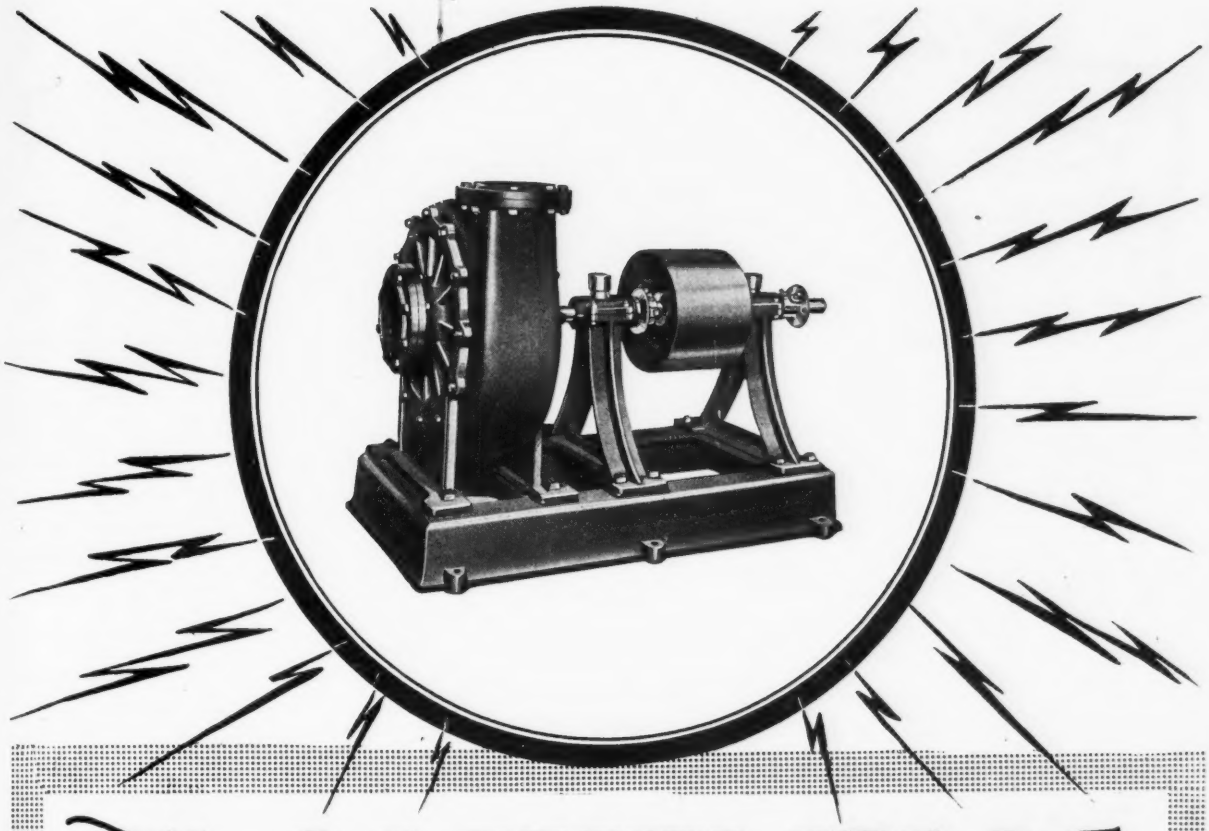
We are after the scalp of this firm of Ellis Island & Co. and we are going to ask you to help us get it. We are not asking you for anything except a chance to work the Hoar Baby Shovel in competition with him for a few days. Then if we lower your costs and increase your production as much as we guarantee beforehand, we want your check for the equipment.

Does it interest you to double your loading tonnage without adding a cent to your costs? If it does—SEND TODAY the details of the materials you are handling and permit our mining staff to make you guaranteed performance recommendations.

CAN WE HAVE YOUR CO-OPERATION?

Yours very truly,
The Hoar Shovel Co., Inc.

The HOAR
BABY STEAM SHOVEL



The LIGHTNING
Sand, Gravel and Dredging Pump

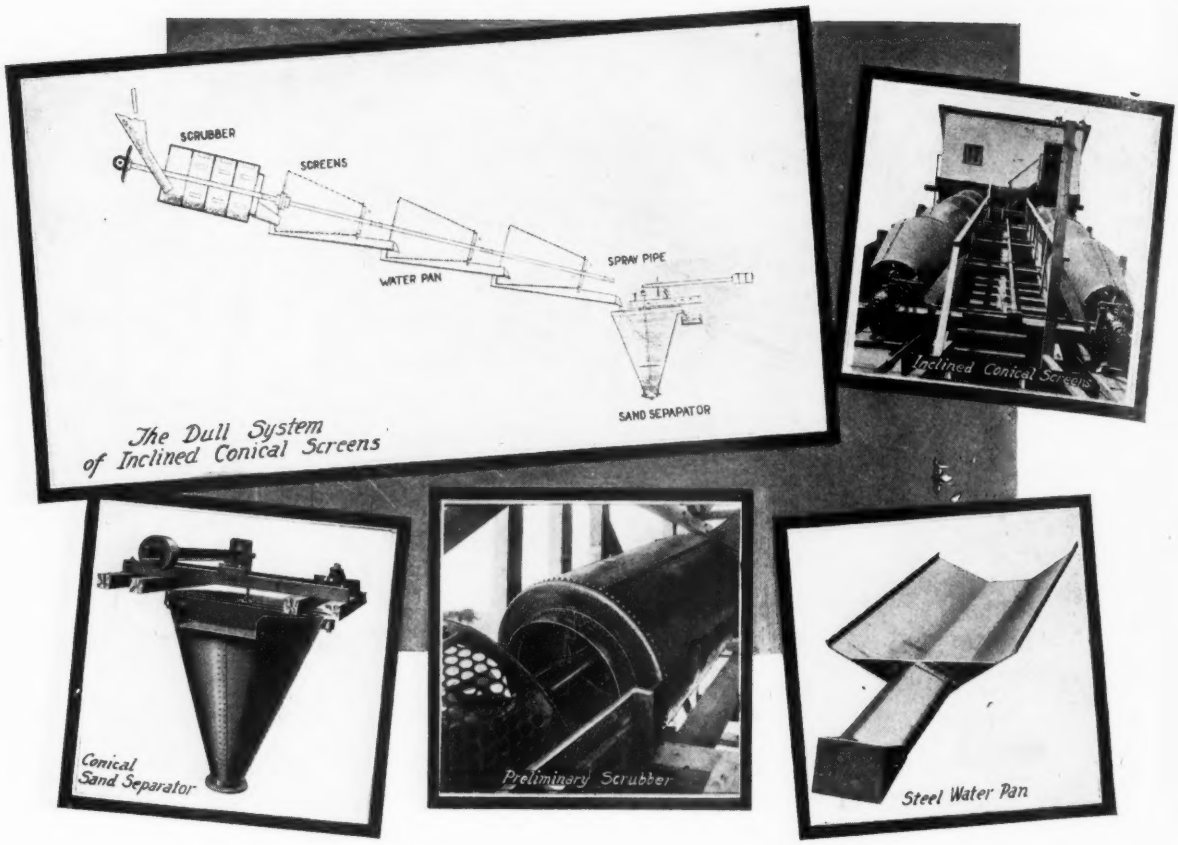
This is the ideal pump for sand and gravel producers. It is easy to operate, easy to adjust and easy to replace parts.

It has that snap in action that makes it go through with the toughest job in a confident way, imparting no sensation of working to the limit of its power—and seems to be able to do even more than is asked of it.

The Lightning is substantial, sure, and will render a service showing a definite saving in operating costs.

Address our pump department for full information and prices

Kansas City Hay Press & Tractor Co.
KANSAS CITY, MO.



GET YOUR EQUIPMENT READY FOR SPRING

BE ready to start operations as soon as spring opens up.

A bit of planning during the winter months, for replacements and additions, will mean maximum production when your plant starts next season.

The Link-Belt Company builds sand and gravel handling equipment that assures a high grade product.

Link-Belt equipment has proven its sturdy qualities and efficiency in production in hundreds of plants, and deserves your consideration when you buy new units.

Link-Belt experienced engineers will be glad to assist you.

1125

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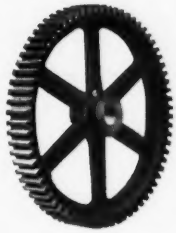
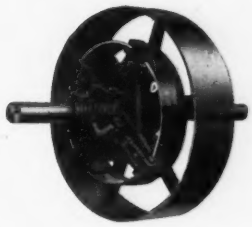
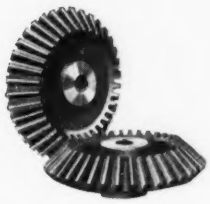




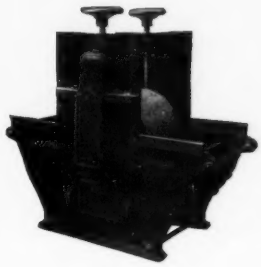


CALDWELL CONVEYOR ACCESSORIES

Insure the continuous working of your Elevating, Conveying and Power Transmission Machinery, by keeping spare parts constantly on hand.

Be prepared for increased business by having all your equipment up to its most effiicent working order. Replace that bucket or chain—now. Make that extension to your plant—now!

C-3



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LINK-BELT COMPANY, OWNER

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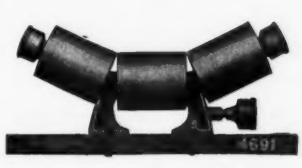
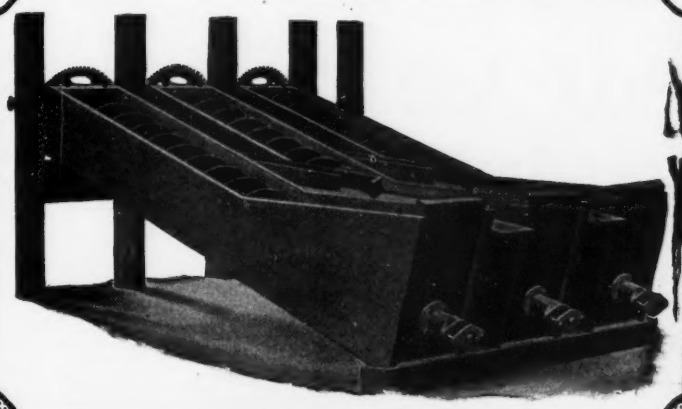




LEWISTOWN
SAND WASHERS

The Lewistown Equipment, which includes Crushing, Grinding, Screening, Washing, Drying and Conveying Machinery will produce more and a better quality of glass sand, at a bigger profit than any other equipment on the market.

These machines are sturdily constructed, giving consistent lasting service. They can be quickly installed, are compact and reasonably priced. Simple in construction and efficient in operation. There is more Lewistown Machinery used in the preparation of glass sand in this country than all other makes combined.

You will find that the Lewistown equipment and service will solve your glass sand producing problems.

Complete information furnished on request

Lewistown Foundry & Machine Company, Lewistown, Pa.

Shaft sinking with DDR-13 "Jackhamer" Trade Mark Reg. U. S. Pat. Office

Where rock is hard and delays are costly

The DDR-13 "Jackhamer" is the ideal drill for shaft sinking through very hard formations. Its weight, extreme ruggedness and powerful blow combine maximum drilling speed with least delay for repairs. The "Jackhamer" is a superior type of self-rotating hand rock drill. It has established an enviable reputation for fast drilling, low upkeep cost, efficiency and durability.

The "Jackhamer" is now made in five weights. The three largest ones are made for use with steam or compressed air. These may also be equipped with or without arrangement for feeding water as well as air through the hollow piston and drill steel to the bottom of the drill hole to allay the dust and remove the cuttings.

Although "Jackhamer" drills are principally used for down-hole drilling and for service where the machine may be held in the operator's hand, mountings are made for the three larger sizes when they are used for drifting or tunneling work.

Request Bulletin No. 4046

INGERSOLL-RAND COMPANY, 11 Broadway, New York

262-JD

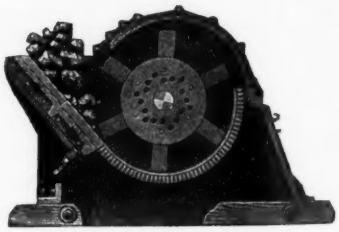
Ingersoll-Rand

When writing advertisers please mention ROCK PRODUCTS

Plant of John Herzog & Sons, Forest, Ohio

John Herzog & Sons Crushing 36" Stone to 1½" with One Crusher

The performance of the Mammoth crusher at the Herzog and other plants clearly stamps it as the greatest improvement in rock crushers in many years. Any stone that can be picked up by their steam shovel can be handled with the Mammoth crusher reducing it to 1½" in one operation. Some of the rock as shown by the above photograph is 36" square by 4 and 5 foot long. Initial investment is cut 50% or more, rock crushing costs are reduced and plant operations simplified, as a single Mammoth crusher takes the place of a preliminary and 2 or 3 secondary crushers. It also lessens the number of elevators, conveyors and screens required and reduces building requirements. Adaptable to any kind of rock crushing, including cement plant work, the crushing of macadam or 6 to 8" limestone for burning. Write for our new booklet and performance records.



Williams Hinged Hammer Equipment Includes

MAMMOTH CRUSHERS for reducing 48" stone to 1½".

JUMBO CRUSHERS for reducing 14" stone, also product of largest preliminary crushers, to 1½" and finer.

JUMBO JUNIOR CRUSHERS for reducing 12" stone to 1½" and finer.

PULVERIZERS.

Williams Patent Crusher & Pulverizer Co.
800 St. Louis Ave., St. Louis, Mo.

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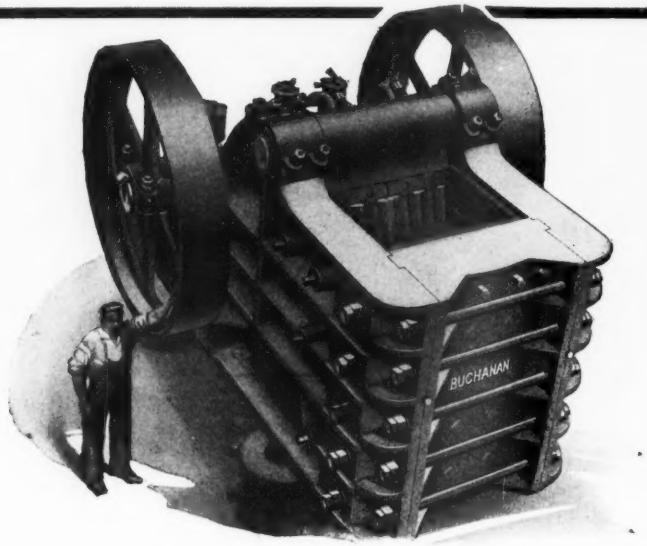
THE WILLIAMS PATENT CRUSHER & PULVERIZER CO. ST. LOUIS MO. U.S.A. TRADE MARK

Williams

PATENT CRUSHERS GRINDERS SHREDDERS

When writing advertisers please mention ROCK PRODUCTS

Buchanan All-Steel Jaw Crushers



Type "C" Buchanan Jaw Crusher

THE precision that goes into Buchanan Jaw Crusher manufacture is reflected in years of continuous service.

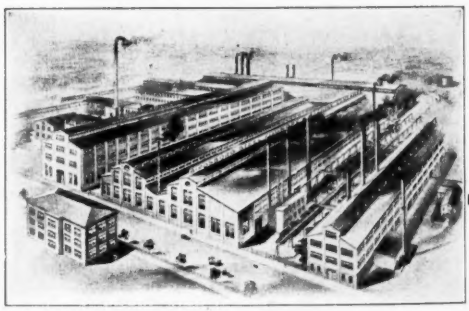
All-steel construction, careful attention to every detail, exact machine work, and experience in design that dates back to the very first crushers of this class—these are the factors that enable Buchanan Crushers to stand up to utmost crushing requirements and deliver the output expected of them.

Buchanan All-Steel Crushers are made in sizes up to and including 66 in. x 84 in.

Send for Bulletin

C. G. BUCHANAN COMPANY, Inc.

Cedar and West Streets **New York City**

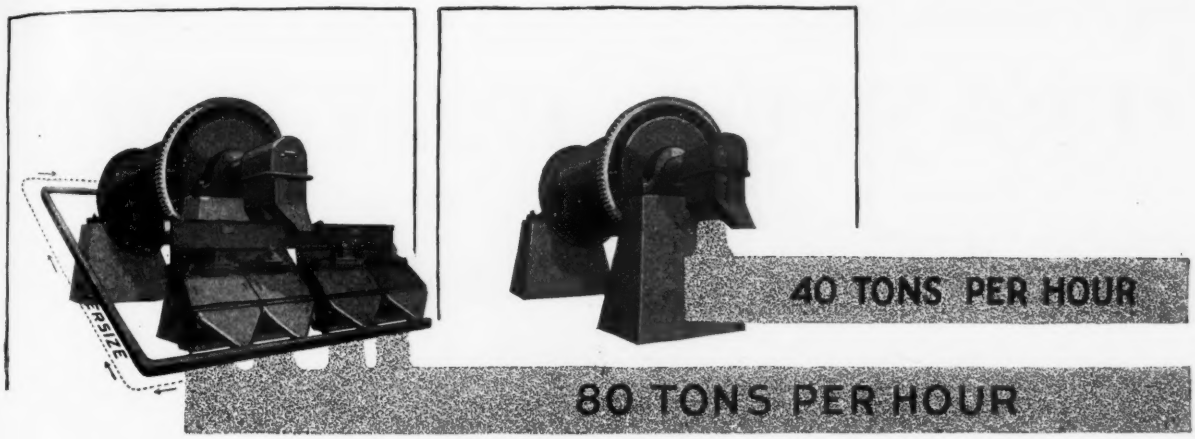


—Q.?—

Where are Buchanan Crushers built?

A.—Every part of the Buchanan Crusher is made in Birdsboro, Pa. From blast-furnace through steel-foundry and machine-shop to erecting and testing floor, every operation is under the direct supervision of the C. G. Buchanan Company.

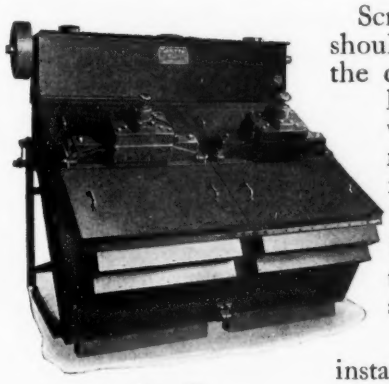
The large capacity of the Birdsboro plant for heavy work is assurance to the Buchanan Crusher buyer that orders will go through promptly and without delay.



CRUSH SCREEN *SEPARATELY!*

Crushing to a finished product is fundamentally wrong—you pay a fearful price by retaining material in the crusher until it is a finished product.

Fines must be removed as fast as they are produced or they will act as a cushion for the coarse material and prevent the crusher doing the work of which it is capable—effective crushing is an impossibility without efficient outside screens.



Type 31
6-Foot, Two Surface
HUM-MER *Electric Screen*

Screening and crushing are two separate operations and should never be joined. Where internal screens are used, the crusher is limited to the capacity of the screen. The longer the fines are held in the crusher, the more they will interfere with the tonnage—to get maximum tonnage, the crusher must be allowed to work on coarse material.

The output of ball mills can be increased as much as 100% by installing HUM-MER Electric Screens to do the screening and then opening up the feed and operating the mill to the limit of its capacity.

Let us tell you what others have accomplished by installing HUM-MERS in closed circuit with crushers and also what the HUM-MER would do for you.

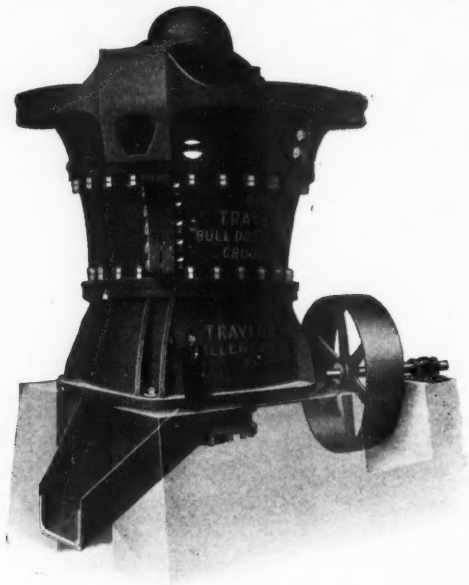
Send for HUM-MER Catalog 45-R

THE W. S. TYLER COMPANY, *Cleveland, Ohio*

Manufacturers of **Woven Wire Screens and Screening Equipment**

ENDURINGLY EFFICIENT

TRAYLOR BULLDOG



THE MASTER GYRATORY

SEVEN exclusive features distinguish the Traylor Bulldog Gyratory Crusher — Hewes, bar type non-weaving spider — improved shaft suspension — non-deflecting, unbreakable shaft — positive force feed lubrication — smooth running cut steel gearing — extra size self aligning eccentric bearing — absolute dust exclusion from the "works."

OWNERS are not prone to enthuse over good service rendered by a machine that they have paid good money for — they expect just that and rightly — wherefore we are particularly gratified by the appreciative letters we have received extolling the performance of the Traylor Bulldog Gyratory.

Bulletin 100-R Describes in Full

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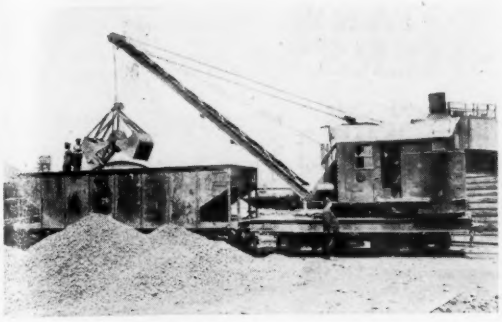

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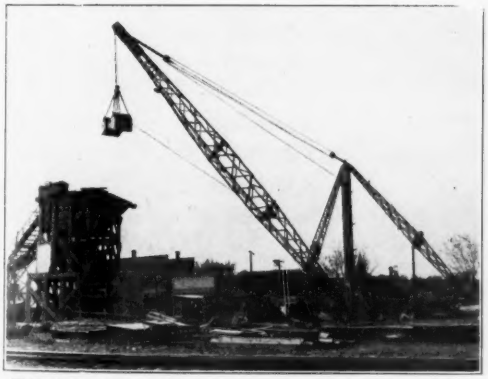

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The Reeves Bros. Co., Alliance, O.
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Orton & Steinbrenner Co., Chicago, Ill.—see page 136
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Weller Mfg. Co., Chicago, Ill.—see page 134

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The Manhattan Rubber Mfg Co., Passaic, N. J.—conveyor, elevator, transmission
The McIlroy Belting & Hose Co., Hammond, Ind.—leather and canvas stitched; conveying, elevating and transmission
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The Webster Mfg. Co., Chicago, Ill.—conveyor—see page 126-127
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The Brown Hoisting Machinery Co., Cleveland, O.—see page 1
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The Galion Iron Works & Mfg. Co., Galion, O.
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Hendrick Mfg. Co., Carbondale, Pa.—see page 125
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The Union Engineering Co., Cleveland, O.
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BLASTING POWDER
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BURR STONES

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John A. Roebling's Sons Co., Trenton, N. J.

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Car Dumper & Equipment Co., Chicago, Ill.
The C. S. Card Iron Works Co., Denver, Colo.
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Continental Car Co. of America, Louisville, Ky.
The O. H. Davidson Equipment Co., Denver, Colo.
The Differential Steel Car Co., Findlay, O.—electric dump.
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C. W. Hunt & Co., Inc., W. New Brighton, N. Y.
Insley Mfg. Co., Indianapolis, Ind.—rocker dump.
International Clay Machinery Co., Dayton, O.—all kinds.
International Motor Co., New York, N. Y.—Mack rail.
Kenova Mine Car Co., Kenova, W. Va.
The Kilbourne & Jacobs Mfg. Co., Columbus, O.—all types.
Koppel Industrial Car & Equipment Co., Koppel, Pa.—all types.
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Kramer Bros. Foundry Co., Dayton, O.—gray iron
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McGann Manufacturing Co., Inc., York, Pa.—gray iron—see page 116
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Pettibone-Mulliken Co. Chicago, Ill.
Philadelphia Steel & Iron Co., Philadelphia, Pa.—iron.
Poole Engineering & Machine Co., Baltimore, Md.—iron, steel.
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A. P. Green Fire Brick Co., Mexico, Mo.
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Cal Chemical Co., Hagerstown, Md.

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Bay City Foundry & Machine Co., Bay City, Mich.
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Lake Shore Engine Works, Marquette, Mich.
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L. B. Foster Co., Inc., Pittsburgh, Pa.
The Godfrey Conveyor Co., Elkhart, Ind.
Lidgerwood Mfg. Co., New York
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When you write to the advertisers and the manufacturers who are listed here—it will pay you to say that you saw it in ROCK PRODUCTS—that's a good habit to form and it will help us too.

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Meese & Gottfried Co., San Francisco, Calif.
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Ann Arbor Foundry Co., Ann Arbor, Mich.
Hadfield-Penfield Steel Co., Bucyrus, O.—see page 152
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Stroh Steel Hardening Process Co., Pittsburgh, Pa.
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CEMENT TESTING APPARATUS

Will Corp., Rochester, N. Y.
Riehle Bros. Testing Mach. Co., Philadelphia, Pa.

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Abell-Howe Co., Chicago, Ill.—high speed drive, power transmission, etc.
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Beach Mfg. Co., Charlotte, Mich.
The Carroll Chain Co., Columbus, O.—welded steam shovel—see page 157
Chain Belt Co., Milwaukee, Wis.—see page 3
Colonial Supply Co., Pittsburgh, Pa.
The Columbus-McKinnon Chain Co., Columbus, O.—welded steam shovel
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Moore & Moore, Inc., Reading, Pa.
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The Stearns Conveyor Co., Cleveland, O.
Sturtevant Mill Co., Boston, Mass.—see page 163
S. G. Taylor Chain Co., Chicago, Ill.
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Geo. Borrowman, Ph.D., Chicago, Ill.
Deavitt Laboratories, Chicago, Ill.
Eimer & Amend, New York, N. Y.
William B. Scaife & Sons Co., Oakmont, Pa.
H. E. Wiedemann, St. Louis, Mo.

CHIMNEYS

Littleford Bros., Cincinnati, O.
Webber Chimney Co., Chicago, Ill.
Wiederholdt Construction Co., New York, N. Y.

CHUTES

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The Allen Cone Co., El Paso, Texas.
Denver Engineering Works Co., Denver, Colo.
Deister Machine Co., Fort Wayne, Ind.
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Cutler-Hammer Mfg. Co., Milwaukee, Wis.
Dodge Mfg. Co., Mishawaka, Ind.
The Hanson Clutch & Machinery Co., Tiffin, O. —friction.
Hesse-Ersted Iron Works, Portland, Ore.
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American Steam Pump Co., Battle Creek, Mich.
Beckwith Machinery Co., Pittsburgh, Pa.
Buhl Machine Co., Chicago, Ill.—portable, stationary.
Bury Compressor Co., Erie, Pa.
Chicago Pneumatic Tool Co., New York, N. Y.—portable, stationary.
Curtis Pneumatic Machinery Co., St. Louis, Mo.
DeLaval Steam Turbine Co., Trenton, N. J.
The Denver Rock Drill Mfg. Co., Denver, Colo.—portable.
Fairbanks, Morse & Co., Chicago, Ill.
Gardner Co., Quincy, Ill.
General Electric Co., Schenectady, N. Y.
Ingersoll-Rand Co., New York, N. Y.—see page 131
Manning, Maxwell & Moore, Inc., New York, N. Y.
Norwalk Iron Works, South Norwalk, Conn.—all kinds.
Novo Engine Co., Lansing, Mich.
Schramm, Inc., West Chester, Pa.
Sullivan Machinery Co., Chicago, Ill.
Wayne Tank & Pump Co., Ft. Wayne, Ind.
Royal C. Wise, Chicago, Ill.
Worthington Pump & Machinery Corp., New York, N. Y.

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Denver Engineering Works Co., Denver, Colo.
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Worthington Pump and Machinery Corp., New York, N. Y.

CONCRETE WATERPROOFING

Cal Chemical Co., Hagerstown, Md.

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The Allen Cone Co., El Paso, Texas.—for dewatering, sand washing, stockpile building, classifying, thickening, etc.
Deister Machine Co., Ft. Wayne, Ind.
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Brown Instrument Co., Philadelphia, Pa.
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Kieley & Mueller, New York, N. Y.
Leeds and Northrup Co., Philadelphia, Pa.
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Wilson Masuleu Co., New York

CONTROLLERS—Electric

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Cutler-Hammer Mfg. Co., Milwaukee, Wis.
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Grindle Fuel Equipment Co., Harvey, Ill.
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Guarantee Construction Co., New York, N. Y.—pneumatic, belt and flight.
The Geo. Haiss Mfg. Co., New York, N. Y.—portable belt—see page 158
The Hamilton Mfg. Co., Columbus, O.—portable stripping.
Hanson Engineering Sales Co., Cleveland, O.
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Holly Pneumatic Systems, Inc., New York, N. Y. —pneumatic.
Howe Chain Co., Muskegon, Mich.
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Kenney-Van Saun Mfg. & Eng. Corp., New York, N. Y.—belt—see page 130
Lansing Motor & Pump Co., Inc., Lansing, Mich. —belt.
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Meese & Gottfried Co., San Francisco, Calif.—belt, bucket and spiral.
W. F. Mosser & Son, Allentown, Pa.—screw.
McKinney-Harrington Co., North Chicago, Ill.—steel bucket and portable.
National Conveying Equipment Corp., Chicago, Ill.—portable.
Northern Conveyor & Mfg. Co., Milwaukee, Wis. —portable.
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Portable Machinery Co., Passaic, N. J.—portable, belt.
Ottumwa Box Car Loader Co., Ottumwa, Ia.—flexible.
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Specialty Engineering Co., Philadelphia, Pa.—belt.
Steacy-Schmidt Mfg. Co., York, Pa.
The Stearns Conveyor Co., Cleveland, O.—belt, apron, screw, and drag.
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The Cleveland Rock Drill Co., Cleveland, O.
Dixon Valve and Coupling Co., Philadelphia, Pa.
S. R. Dresser Mfg. Co., Bradford Pa.—steel pipe.
The Electric Controller & Mfg. Co. Cleveland, O.—flexible.
Fawcus Machine Co., Pittsburgh, Pa.
Foote Bros. Gear and Machine Co., Chicago, Ill.
The B. F. Goodrich Co., Akron, O.
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Clyde Iron Works, Duluth, Minn.—traction gantry.
H. D. Conkey & Co., Mendota, Ill.
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Forsythe Bros., New York, N. Y.—steam, locomotive and gasoline.
The Hayward Co., New York, N. Y.—gantry.
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Anderson Foundry & Machine Co., Anderson, Ind.—oil.
The Automatic Furnace Co., Dayton, O.—steam.
Earle C. Bacon, Inc., New York, N. Y.—hoisting—see page 28
Beckwith Machinery Co., Pittsburgh, Pa.
The Brownell Co., Dayton, O.—steam
The Buckeye Machine Co., Lima, O.—oil.
The Buda Co., Chicago, Ill.—gasoline.
The Buffalo Hoist & Derrick Co., Buffalo, N. Y.
Busch-Sulzer Bros. Diesel Engine Co., St. Louis, Mo.

There is no other journal that gives you market prices and quotations of the various materials produced by this industry. That service alone signals the leadership of ROCK PRODUCTS

Charter Gas Engine Co., Sterling, Ill.—gasoline, gas, kerosene and oil.
Chicago Pneumatic Tool Co., New York, N. Y.—gas, oil and steam.
Climax Engineering Co., Clinton, Ia.—gasoline and kerosene for steam shovels, cranes, etc.—see insert
Clyde Iron Works, Duluth, Minn.—gasoline, steam and belt hoisting.
The Cook Motor Co., Delaware, O.—gas, gasoline, and kerosene.
De La Verne Engine Co., New York, N. Y.—diesel.
Dodge Sales and Engineering Co., Mishawaka, Ind.
Ellicott Machine Corp., Baltimore, Md.—see page 163
Erie City Iron Works, Erie, Pa.—steam.
Evinrude Motor Co., Milwaukee, Wis.—gasoline—see page 116
Erie Pump and Engine Works, Erie, Pa.—steam.
S. Flory Mfg. Co., Bangor, Pa.—hoisting—see page 147
Fairbanks, Morse & Co., Chicago, Ill.—gasoline and semi-diesel.
Forsythe Bros., New York, N. Y.—hoisting.
Good Roads Machinery Co., Kennett Square, Pa.—see page 135
Hadfield-Penfield Steel Co., Bucyrus, O.—diesel—see page 152
The Houston, Stanwood & Gamble Co., Inc., Cincinnati, O.—steam
Ideal Engine Co., Lansing, Mich.—gas.
Ingersoll-Rand Co., New York, N. Y.—oil, steam and gas—see page 131
Kahlenberg Bros. Co., Two Rivers, Wis.—oil.
Lansing Motor & Pump Co., Lansing, Mich.—hoisting.
Lidgerwood Mfg. Co., Chicago, Ill.—steam, electric and gasoline.
McIntosh and Seymour Corp., Auburn, N. Y.—semi-diesel
Mine and Smelter Supply Co., New York, N. Y.
Morris Machine Works, Baldwinsville, N. Y.—steam—see page 160
Muncie Oil Engine Co., Muncie, Ind.
J. S. Mundy Hoisting Engine Co., Newark, N. J.—see page 167
Murray Iron Works Co., Burlington, Ia.—steam.
New Holland Machine Co., New Holland, Pa.—see page 162
Novo Engine Co., Lansing, Mich.—gas
Orr & Sembower, Reading, Pa.—steam, electric and gasoline hoisting.
The Otto Engine Works, Philadelphia, Pa.—gas, gasoline, oil.
Pittsburg Mining Machinery Co., Pittsburgh, Pa.
The Power Mfg. Co., Marion, O.—semi-diesel.
Saxe & Heald, Chicago, Ill.—steam
Schramm, Inc., West Chester, Pa.—gasoline.
The St. Mary's Oil Engine Co., St. Charles, Mo.—diesel.
The T. L. Smith Co., Milwaukee, Wis.—gas
H. N. Strait Mfg. Co., Kansas City, Mo.—gas.
B. F. Sturtevant Co., Boston, Mass.—steam
Superior Iron Works, Superior, Wis.—steam
Universal Motor Co., Oshkosh, Wis.—gas.
Venn Severin Machine Co., Chicago, Ill.—oil.
The Wellman-Seaver-Morgan Co., Cleveland, O.—gasoline.
Worthington Pump & Machinery Corp., New York, N. Y.—oil.

EXCAVATING MACHINERY

Austin Machinery Corp., Toledo, O.
Bay City Dredge Works, Bay City, Mich.
Blaw-Knox Co., Pittsburgh, Pa.—see page 158
Brown Hoisting Machinery Co., Cleveland, O.—see page 1
Bucyrus Co., South Milwaukee, Wis.—all types.—see page 27
The Byers Machine Co., Ravenna, O.—derrick, drainage and trench.—see page 167
Cable Excavator Co., Fernwood, Pa.—dragline cableway.
Erie Steam Shovel Co., Erie, Pa.—see page 161
Good Roads Machinery Co., Kennett Square, Pa.—see page 135
Hayward Co., New York, N. Y.
Indianapolis Cable Excavator Co., Indianapolis, Ind.—slack line.
Industrial Works, Bay City, Mich.—see page 161
Keystone Driller Co., Beaver Falls, Pa.
Koehring Co., Milwaukee, Wis.—dragline, crane.—see page 20-21
Lidgerwood Mfg. Co., New York, N. Y.
Link-Belt Co., Chicago, Ill.—dragline cableway.—see page 122 and back cover
Monighan Machinery Co., Chicago, Ill.
The Marion Steam Shovel Co., Marion, O.—all kinds.—see page 32
Northwest Engineering Co., Chicago, Ill.—see insert
Orton & Steinbrenner, Chicago, Ill.—see page 136
The Osgood Co., Marion, O.—see page 161
Sauerman Bros., Chicago, Ill.—see page 157
Schofield-Burkett Construction Co., Macon, Ga.—for stripping and loading.
T. L. Smith Co., Milwaukee, Wis.
Thew Shovel Co., Lorain, O.—see page 31
The Union Engineering Co., Cleveland, O.

EXPLOSIVES AND BLASTING SUPPLIES

Atlas Powder Co., Wilmington, Del.
E. I. du Pont de Nemours & Co., Wilmington, Del.
General Explosives Co., Chicago, Ill.
The Giant Powder Co., Con., San Francisco, Calif.
The Grasselli Powder Co., Cleveland, O.
Hercules Powder Co., Wilmington, Del.
Illinois Powder Mfg. Co., St. Louis, Mo.
Trojan Powder Co., Allentown, Pa.

Buyers' Directory
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FANS

American Blower Co., Detroit, Mich.
Buckeye Blower Co., Columbus, O.
Buffalo Forge Co., Buffalo, N. Y.
The Champion Blower & Forge Co., Lancaster, Pa.
The Jeffrey Mfg. Co., Columbus, O.—see page 24-25
Pittsburgh Mining Machinery Co., Pittsburgh, Pa.
The Raymond Bros. Impact Pulverizer Co., Chicago, Ill.—exhaust.—see page 128
B. F. Sturtevant Co., Boston, Mass.

FASTENERS—(Belt)

The Bristol Co., Waterbury, Conn.
Flexible Steel Lacing Co., Chicago, Ill.

FEEDERS

The Automatic Furnace Co., Dayton, O.—coal.
C. O. Bartlett and Snow Co., Cleveland, O.
C. G. Buchanan Co., Inc., New York, N. Y.—see page 140
Chalmers and Williams, Inc., Chicago Heights, Ill.
Dodge Sales and Engineering Co., Mishawaka, Ind.
Good Roads Machinery Co., Inc., Kennett Square, Pa.—apron.—see page 135
The Greenville Mfg. Co., Greenville, O.—automatic rotary.—see page 154
Gruendler Patent Crusher and Pulverizer Co., St. Louis, Mo.—stone see page 118
The Jeffrey Mfg. Co., Columbus, O.—see page 24-25
Kennedy-Van Saun Mfg. & Eng. Corp., New York, N. Y.—disc, plunger, pendulum, roll, pan.—see page 130
Link-Belt Co., Chicago, Ill.—apron.—see page 122 and back cover
Maddox Foundry & Machine Co., Archer, Fla.
Meese & Gottfried Co., San Francisco, Calif.
Robins Conveyng Belt Co., New York, N. Y.—see page 26
Saxe & Heald, Chicago, Ill.—coal.
F. L. Smidth & Co., New York, N. Y.—slurry, coal, cradle, dry, etc.—see page 23
Smith Engineering Works, Milwaukee, Wis.—see page 155
The Stearns Conveyor Co., Cleveland, O.
Stephens-Adamson Mfg. Co., Aurora, Ill.
W. Toepfer & Sons Co., Milwaukee, Wis.—see page 139
Traylor Engineering & Mfg. Co., Allentown, Pa.—see page 142
The Webster Mfg. Co., Chicago, Ill.—see page 126-127
Weller Mfg. Co., Chicago, Ill.—see page 134
Williams Patent Crusher & Pulverizer Co., St. Louis, Mo.—automatic—see page 132

FEED WATER HEATERS

The Brownell Co., Dayton, O.
The Houston, Stanwood & Gamble Co., Inc., Cincinnati, O.
Saxe & Heald, Chicago, Ill.
The Superheater Co., New York, N. Y.
Worthington Pump and Machinery Corp., New York, N. Y.

FEED WATER REGULATOR

Co-operative Utilities Co., Philadelphia, Pa.

FIRE APPARATUS

Federal Electric Co., Chicago, Ill.—alarms.
Foamite-Childs Corporation, Utica, N. Y.
Howe Fire Apparatus Co., Anderson, Ind.
International Motor Co., New York, N. Y.
Mine Safety Appliances Co., Pittsburgh, Pa.
Safety First Supply Co., Pittsburgh, Pa.

FORGES

Armstrong Mfg. Co., Waterloo, Ia.—see page 192
C. C. Bradley and Sons, Syracuse, N. Y.
Buffalo Forge Co., Buffalo, N. Y.
The Champion Blower & Forge Co., Lancaster, Pa.
Denver Rock Drill Mfg. Co., Denver, Colo.—oil, for drill steel.
Hauck Manufacturing Co., Brooklyn, N. Y.
The Hill Clutch Co., Cleveland, O.
Ingersoll-Rand Co., New York, N. Y.—see page 131
Manning, Maxwell & Moore, Inc., New York, N. H.
Newhall Chain Forge & Iron Co., New York, N. Y.
Philadelphia Steel & Iron Co., Philadelphia, Pa.

FIRE BRICK

Ashland Fire Brick Co., Ashland, Ky.
Basic Products Co., St. Louis, Mo.
Betson Plastic Fire Brick Co., Rome, N. Y.
Chicago Retort & Fire Brick Co., Chicago, Ill.
Chicago Fire Brick Co., Chicago, Ill.
Eastern Clay Goods Co., Boston, Mass.
Foote Mineral Co., Inc., Philadelphia, Pa.
A. P. Green Fire Brick Co., Mexico, Mo.
Laclede-Christy Co., St. Louis, Mo.
Robinson Clay Product Co., New York, N. Y.

Thomas Moulding Brick Co., Chicago, Ill.
Walsh Fire Clay Products Co., St. Louis, Mo.

FUEL OIL SYSTEMS

Bowser & Co., Inc., Ft. Wayne, Ind.
Flinn & Freffein Co., Chicago, Ill.
Grindle Fuel Equipment Co., Harvey, Ill.
Wayne Tank & Pump Co., Ft. Wayne, Ind.

FURNACES

Allis-Chalmers Mfg. Co., Milwaukee, Wis.—see page 14-15
American Gas Furnace Co., Elizabeth, N. J.
The Automatic Furnace Co., Dayton, O.
General Chemical Co., New York, N. Y.
Glamorgan Pipe & Foundry Co., Lynchburg, Va.
Ingersoll-Rand Co., New York, N. Y.—see page 131
Manning, Maxwell & Moore, Inc., New York, N. Y.
Pacific Foundry Co., San Francisco, Calif.
Saxe & Heald, Chicago, Ill.
Sullivan Machinery Co., Chicago, Ill.
Traylor Engineering & Mfg. Co., Allentown, Pa. see page 142
Worthington Pump and Machinery Corp., New York, N. Y.

FUSES—(Blasting)

Atlas Powder Co., Wilmington, Del.
E. I. du Pont de Nemours & Co., Wilmington, Del.
Ensign-Bickford Co., Simsbury, Conn.—Cordeau-Bickford detonating.—see page 130
The Giant Powder Co., Cons., San Francisco, Calif.
The Grasselli Powder Co., Cleveland, O.
Hercules Powder Co., Wilmington, Del.
Illinois Powder Mfg. Co., St. Louis, Mo.
Trojan Powder Co., Allentown, Pa.

FUSES—(Electrical)

Bussmann Mfg. Co., St. Louis, Mo.
Chicago Fuse Mfg. Co., Chicago, Ill.
Colonial Supply Co., Pittsburgh, Pa.
Economy Fuse & Mfg. Co., Chicago, Ill.
Federal Electric Co., Chicago, Ill.
General Electric Co., Schenectady, N. Y.
Westinghouse Electric and Mfg. Co., E. Pittsburgh, Pa.

GAUGES

The Brown Instrument Co., Philadelphia, Pa.—draft
General Electric Co., Schenectady, N. Y.

GAS ENGINES—See Engines

GAS PRODUCERS

The Chapman Engineering Co., Mt. Vernon, O.
Duff Patents Co., Inc., Pittsburgh, Pa.
Flinn & Freffein Co., Chicago, Ill.
McGann Manufacturing Co., Inc., York, Pa.—see page 116
Morgan Construction Co., Worcester, Mass.—see page 154
The Otto Engine Works, Philadelphia, Pa.
Wellman-Seaver-Morgan Co., Cleveland, O.
R. D. Wood & Co., Philadelphia, Pa.—see page 9

GASKETS

The Booth Felt Co., Inc., Chicago, Ill.
Colonial Supply Co., Pittsburgh, Pa.
Crane Co., Chicago, Ill.
Jenkins Bros., New York, N. Y.
McCord Mfg. Co., Inc., Detroit, Mich.
New York Belting & Packing Co., New York, N. Y.
Quaker City Rubber Co., Philadelphia, Pa.

GATES—(Bin)

Allis-Chalmers Mfg. Co., Milwaukee, Wis.—see page 14-15
Austin Mfg. Co., Chicago, Ill.—see page 150
Earle C. Bacon, Inc., New York, N. Y.—see page 28
The C. O. Bartlett and Snow Co., Cleveland, O.
Beaumont Mfg. Co., Philadelphia, Pa.
Brown Hoisting Machinery Co., Cleveland, O.—see page 1
The C. S. Card Iron Works Co., Denver, Colo.
Good Roads Machinery Co., Inc., Kennett Square, Pa.—chutes.—see page 135
Chalmers & Williams, Chicago Heights, Ill.
Greenville Mfg. Co., Greenville, O.—see page 154
C. W. Hunt & Co., Inc., W. New Brighton, N. Y.
Link-Belt Co., Chicago, Ill.—see page 122 and back cover
Meese & Gottfried, San Francisco, Calif.
Robins Conveying Belt Co., New York, N. Y.—see page 26
Rogers Foundry & Machine Co., Joplin, Mo.
James B. Seaverns, Chicago, Ill.
T. L. Smith Co., Milwaukee, Wis.
Smith Engineering Works, Milwaukee, Wis.—see page 155
Sturtevant Mill Co., Boston, Mass.—see page 163
W. Toepfer & Sons Co., Milwaukee, Wis.—see page 139
Traylor Engineering & Mfg. Co., Allentown, Pa.—see page 142
Webster Mfg. Co., Chicago Ill.—see page 126-127
Weller Mfg. Co., Chicago, Ill.—see page 134
Worthington Pump & Machinery Corp., New York, N. Y.

GEARS

Albaugh-Dover Co., Chicago, Ill.
B. & W. Oil-less Conveyor Co., Chicago, Ill.
H. W. Caldwell & Son Co., Chicago, Ill.—see page 123

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W. E. Caldwell Co., Louisville, Ky.
Chain Belt Co., Milwaukee, Wis.—cast.—see page 3
The Cleveland Worm & Gear Co., Cleveland, O. —worm.—see page 145
De Laval Steam Turbine Co., Trenton, N. J.—double helical.
Denver Engineering Works Co., Denver, Colo.
Dodge Sales and Engineering Co., Mishawaka, Ind.—conveyor and friction.
The Falk Corp., Milwaukee, Wis.
Fawcus Machine Co., Pittsburgh, Pa.
Foote Bros. Gear & Mach. Co., Chicago, Ill.
Fuller-Lehigh Co., Fullerton, Pa.
William Ganschow Co., Chicago, Ill.
General Electric Co., Schenectady, N. Y.
Hesse-Ersted Iron Works, Portland, Ore.
Hill Clutch Co., Cleveland, O.
Inland Engineering Co., Chicago, Ill.—see page 164
D. O. James Mfg. Co., Chicago, Ill.
W. A. Jones Foundry & Machine Co., Chicago, Ill.
The Jeffrey Mfg. Co., Columbus, O.—see page 24-25
Link-Belt Co., Chicago, Ill.—see page 122 and back cover
The Medart Co., St. Louis, Mo.
Meese & Gottfried Co., San Francisco, Calif.
Moore Steam Turbine Co., Wellsville, N. Y.
Morse Chain Co., Ithaca, N. Y.—silent chain, spring.—see page 6-7
W. F. Mosser & Son, Allentown, Pa.
Philadelphia Gear Works, Philadelphia, Pa.
Pettibone Mulliken Co., Chicago, Ill.
Niles-Bement-Pond Co., New York, N. Y.
R. D. Nuttall Co., Pittsburgh, Pa.
A. Plamondon Mfg. Co., Chicago, Ill.
The Poole Engineering & Machine Co., Baltimore, Md.
Robins Conveying Belt Co., New York, N. Y.—see page 26
Stroh Steel-Hardening Process Co., Pittsburgh, Pa.
Superior Iron Works Co., Superior, Wis.
Taylor-Wharton Iron & Steel Co., High Bridge, N. J.—manganese steel.—see page 133
Terry Steam Turbine Co., Hartford, Conn.
Tool Steel Gear & Pinion Co., Cincinnati, O.—spur, bevel and tooth.
Vulcan Iron Works, Wilkes-Barre, Pa.—see page 153
Webster Mfg. Co., Chicago, Ill.—see page 126-127
Weller Mfg. Co., Chicago, Ill.—see page 134
Westinghouse Electric and Mfg. Co., East Pittsburgh, Pa.

GENERATORS—Electrical

See Electric Motors

GLASS SAND EQUIPMENT

Lewistown Foundry & Machine Co., Lewistown, Pa.—see page 129
Kennedy-Van Saun Engineering & Machinery Co., New York, N. Y.—see page 130
Stevenson Co., Wellsville, O.

GRATES

The Automatic Furnace Co., Dayton, O.—shaking and dumping.
Canton Grate Co., Canton, O.
Combustion Engineering Corp., New York, N. Y.
Gehret Bros., Inc., Bridgeport, Pa.
The Houston, Stanwood & Gamble Co., Inc., Cincinnati, O.
Kramer Bros. Foundry Co., Dayton, O.—shaking and dumping
Saxe & Heald, Chicago, Ill.

GREASE

(See Lubricants)

GRIZZLIES

Allis-Chalmers Mfg. Co., Milwaukee, Wis.—see page 14-15
C. S. Card Iron Works Co., Denver, Colo.
Chalmers & Williams, Chicago Heights, Ill.
Gruendler Pat. Cr. & Pulv. Co., St. Louis, Mo.—see page 118
Robins Conveying Belt Co., New York, N. Y.—see page 26
Rogers Foundry & Machine Co., Joplin, Mo.
Smith Engineering Works, Milwaukee, Wis.—see page 155
W. Toepfer & Sons Co., Milwaukee, Wis.—see page 139
Traylor Engineering & Mfg. Co., Allentown, Pa.—see page 142
The Webster Mfg. Co., Chicago, Ill.—see page 126-127
Weller Mfg. Co., Chicago, Ill.—see page 134
Western Wheeled Scraper Co., Aurora, Ill.
Williams Pat. Cr. & Pub. Co., St. Louis, Mo.—see page 132

Henry Ford says that his plants never retain machinery and equipment when a new kind will cut the costs of production. We can't all be Henrys—but if you make a business of reading the ads and writing advertisers you will come near to the principle Ford has capitalized on so big.

GYPSUM AND GYPSUM PLASTER PLANTS

Butterworth & Lowe, Grand Rapids, Mich.—see page 162
J. B. Ehrsam & Sons Mfg. Co., Enterprise, Kans.—see page 124
Richard K. Meade & Co., Baltimore, Md.—see page 166

HAIR PICKERS

J. B. Ehrsam & Sons Mfg. Co., Enterprise, Kan.—see page 124

HANGERS

Colonial Supply Co., Pittsburgh, Pa.
Dodge Sales & Engineering Co., Mishawaka, Ind.
W. A. Jones Foundry & Machine Co., Chicago, Ill.—shaft.
Link-Belt Co., Chicago, Ill.—electric.—see page 122 and back cover
The Medart Co., St. Louis, Mo.
Meese & Gottfried Co., San Francisco, Calif.
The Webster Mfg. Co., Chicago, Ill.—see page 126-127
Weller Mfg. Co., Chicago, Ill.—see page 134

HEATERS—See Blow Torches

HOISTS—(Steam, Gasoline and Electric)

Allis-Chalmers Mfg. Co., Milwaukee, Wis.—see page 14-15
The American Cement Machine Co., Inc., Keokuk, Ia.
American Hoist & Derrick Co., St. Paul, Minn.—see page 161
Austin Manufacturing Co., Chicago, Ill.—see page 150
Austin-Western Road Machinery Co., Chicago, Ill. —see page 150
The C. O. Bartlett and Snow Co., Cleveland, O.
Earle C. Bacon, Inc., New York, N. Y.—see page 28
Beach Mfg. Co., Charlotte, Mich.—double drum.
R. H. Beaumont Co., Philadelphia, Pa.—skip.
Bedford Foundry & Machine Co., Bedford, Ind.—power.
Beckwith Machinery Co., Pittsburgh, Pa.
The Brown Hoisting Machinery Co., Cleveland, O. —see page 1
Buffalo Hoist & Derrick Co., Buffalo, N. Y.
The Byers Machine Co., Ravenna, O.—steam, gasoline, electric and belt.—see page 167
James H. Channon Mfg. Co., Chicago, Ill.
Chicago Pneumatic Tool Co., New York, N. Y.—air.
Clyde Iron Works, Duluth, Minn.
Columbian Steel Tank Works, Kansas City, Mo. —truck.
Conveyors Corp. of America, Chicago, Ill.
Denver Engineering Works Co., Denver, Colo.—electric.
Denver Rock Drill Mfg. Co., Denver, Colo.—pneumatic.
Dobbie Foundry & Machine Co., Niagara Falls, N. Y.
English Tool & Supply Co., Kansas City, Mo.
Erie Clutch & Pulley Co., Erie, Pa.
The Erie Hoist Co., Erie, Pa.—all kinds.
Exeter Machine Works, Inc., West Pittston, Pa.
Fairbanks, Morse & Co., Chicago, Ill.
S. Flory Mfg. Co., Bangor, Pa.—see page 147
The Godfrey Conveyor Co., Elkhart, Ind.
Good Roads Machinery Co., Kennett Square, Pa. —see page 135
L. P. Green, Chicago, Ill.
Gruendler Patent Crusher & Pulverizer Co., St. Louis, Mo.—see page 118.
Guarantee Construction Co., New York, N. Y.
The Geo. Haiss Mfg. Co., Inc., New York, N. Y. —see page 158
The Hayward Co., New York, N. Y.
The Heil Co., Milwaukee, Wis.—truck.
Joshua Hendy Iron Works, San Francisco, Calif.
C. W. Hunt & Co., Inc., W. New Brighton, N. Y.
Ideal Engine Co., Lansing Mich.—gas.
Ingersoll-Rand Co., New York, N. Y.—air.—see page 131
Jeffrey Mfg. Co., Columbus, O.—skip.—see page 24-25
Lake Shore Engine Works, Marquette, Mich.
Lambert Hoisting Engine Co., Newark, N. J.
Lansing Motor & Pump Co., Lansing, Mich.—drum, drag-line.
Lidgerwood Mfg. Co., New York, N. Y.
Link-Belt Co., Chicago, Ill.—electric, see page 122 back cover
Manning, Maxwell & Moore, Inc., New York, N. Y.—chain.
McLanahan-Stone Machine Co., Hollidaysburg, Pa.—friction and electric.—see page 163
The Marion Steam Shovel Co., Marion, O.—see page 32
Maris Brothers, Inc., Philadelphia, Pa.—electric.
Meese & Gottfried Co., San Francisco, Calif.—plain, geared and friction.
Mining Machine Co., Mountville, Pa. — motor driven.—see page 159
Motorbloc Corporation, Summerdale, Philadelphia, Pa.—chain driven.
J. S. Mundy Hoisting Engine Co., Newark, N. J. —see page 167
National Hoisting Engine Co., Harrison, N. J.
Northern Engineering Works, Detroit, Mich.—monorail grab bucket, electric and air.
Novo Engine Co., Lansing, Mich.
O. K. Clutch & Machinery Co., Columbia, Pa.—drum, reversible and non-reversible, gasoline, electric or belt drive.
Orr & Sembower, Reading, Pa.
Ottumwa Iron Works, Ottumwa, Ia.—electric and steam.—see page 146
Pawling & Harnischfeger Co., Milwaukee, Wis.
Patten Mfg. Co., Chattanooga, Tenn.—gasoline, electric, belt.
Pittsburgh Mining Machinery Co., Pittsburgh, Pa.
The Pneumelectric Corp., Syracuse, N. Y.
Jos. T. Ryerson & Son, Chicago, Ill.
Schramm, Inc., West Chester, Pa.—compressor.
Smith Engineering Works, Milwaukee, Wis.—see page 155
Standard Steel Works, North Kansas City, Mo.—truck.

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Sullivan Machinery Co., Chicago, Ill.—air.
Thomas Elevator Co., Chicago, Ill.—band and cone friction.—see page 147
Universal Hoist & Mfg. Co., Cedar Falls, Ia.
Vulcan Iron Works, Wilkes-Barre, Pa.—see page 153
Weller Mfg. Co., Chicago, Ill.—see page 134
Wellman-Seaver-Morgan Co., Cleveland, O.
Wood-Detroit Hydraulic Hoist Co., Detroit, Mich.
Wright Mfg. Co., Lisbon, O.—high speed.

HOOKS

The Columbus McKinnon Chain Co., Columbus, O.
Macwhyte Co., Kenosha, Wis.
Newhall Chain Forge & Iron Co., New York, N. Y.
United States Chain & Forging Co., Pittsburgh, Pa.
The Wellman-Seaver-Morgan Co., Cleveland, O.

HOPPERS AND SPOUTS

Atlas Engineering Co., Milwaukee, Wis.
Biehl Iron Works, Reading, Pa.
Ding Magnetic Separator Co., Milwaukee, Wis.—spouts.
The Galion Iron Works & Mfg. Co., Galion, O.
Gruendler Pat. Crusher & Pulv. Co., St. Louis, Mo.—see page 118
The Greenville Mfg. Co., Greenville, O.—see page 154
Littleford Bros., Cincinnati, O.—hoppers.
Magnetic Mfg. Co., Milwaukee, Wis.—magnetic spouts.—see page 8
Meese & Gottfried Co., San Francisco, Calif.
The Reeves Bros. Co., Alliance, O.—hoppers.
Rogers Foundry & Machine Co., Joplin, Mo.
James B. Seaverns, Chicago, Ill.—steel.
Steacy-Schmidt Mfg. Co., New York, N. Y.
Sturtevant Mill Co., Boston, Mass.—see page 163
The Union Engineering Co., Cleveland, O.
Webb City & Carterville Fndry. & Mach. Co., Webb City, Mo.—see page 165
The Youngstown Boiler & Tank Co., Youngstown, O.—cement screen.

HOSE—(Water, Steam, Pneumatic, Air Drill)

The Alexander Milburn Co., Baltimore, Md.—welding.
The American Metal Hose Co., Waterbury, Conn.—flexible metal.
Badger Belt & Rubber Corp., Milwaukee, Wis.
Chicago Penumatic Tool Co., New York, N. Y.
The Cleveland Rock Drill Co., Cleveland, O.
The Cincinnati Rubber Mfg. Co., Cincinnati, O.
Edson Mfg. Corp., Boston, Mass.
Empire Tire & Rubber Corp., Chicago, Ill.
B. F. Goodrich Rubber Co., Akron, O.—all kinds.
The Goodyear Tire & Rubber Co., Akron, O.
Hardscog Wonder Drill Co., Ottumwa, Ia.
Ingersoll-Rand Co., New York, N. Y.—see page 131
The Manhattan Rubber Mfg. Co., Chicago, Ill.—all kinds.
The McIlroy Belting & Hose Co., Hammond, Ind.
Mulconroy Co., Philadelphia, Pa.—flexible metallic, all kinds.
New York Belting & Packing Co., New York, N. Y.
New York Rubber Co., New York, N. Y.
Quaker City Rubber Co., Philadelphia, Pa.
The Republic Rubber Co., Youngstown, O.—all kinds.
Robins Conveying Belt Co., New York, N. Y.—see page 26
Rossendale-Reddaway Belting & Hose Co., Newark, N. J.
W. H. Salisbury & Co., Inc., Chicago, Ill.
Schramm, Inc., West Chester, Pa.—air.
United States Rubber Co., Akron, O.

HOUSES—(Portable)

Littleford Bros., Cincinnati, O.
Meese & Gottfried, San Francisco, Calif.
Wisconsin Bridge & Iron Co., N. Milwaukee, Wis.

HYDRATING EQUIPMENT

Atlas Car & Mfg. Co., Cleveland, O.—see page 160
The Kritzer Co., Chicago, Ill.—see page 162
McGann Mfg. Co., Inc., York, Pa.—see page 116
Richard K. Meade & Co., Baltimore, Md.—see page 166
H. Miscampbell Co., Duluth, Minn.—see page 138
Schaffer Eng. & Equipment Co,, Pittsburgh, Pa.—see inside front cover
Steacy-Schmidt Mfg. Co., New York, N. Y.
W. Toepfer & Sons Co., Milwaukee, Wis.—see page 139

INSULATION—(Heat)

Celite Products Co., Chicago, Ill.—cement kiln, boiler, lime kiln, high temperature cements—see front cover
Johns-Manville, Inc., New York, N. Y.

KETTLES—(Calcining)

Butterworth & Lowe, Grand Rapids, Mich.,—see page 162
The Reeves Bros. Co., Alliance, O.
Standard Steel Works, North Kansas City, Mo.
J. B. Ehrsam & Sons Co., Enterprise, Kas.—see page 124

KILNS

Allis-Chalmers Mfg. Co., Milwaukee, Wis.—see page 14-15
Arnold & Weigel, Woodville, O.—shaft.
C. O. Bartlett & Snow Co., Cleveland, O.
Blaw-Knox Co., Pittsburgh, Pa.—see page 158
The Bonnot Co., Canton, O.—rotary

The Denver Engineering Works Co., Denver, Colo.—rotary lime and cement
Duff Patents Co., Inc., Pittsburgh, Pa.—rotary and shaft
Glamorgan Pipe & Foundry Co., Lynchburg, Va.
Joshua Hendy Iron Works, San Francisco, Calif.
Hendrick Mfg. Co., Carbondale, Pa.—lime—see page 125
The Improved Equipment Co., New York, N. Y.—vertical type, Doherty-Eldred process
Kennedy-Van Saun Mfg. & Eng. Corp., New York, N. Y.—see page 130
McGann Mfg. Co., Inc., York, Pa.—rotary and vertical—see page 116
W. F. Mosser & Son, Allentown, Pa.—rotary
The Reeves Bros. Co., Alliance O.—rotary, cement and lime
Ruggles-Coles Engineering Co., New York, N. Y.
Schaffer Engineering & Equipment Co., Pittsburgh, Pa.—see inside front cover
F. L. Smidth & Co., New York, N. Y.—rotary.—see page 23
Steacy-Schmidt Mfg. Co., New York, N. Y.—shaft
Stearns-Roger Mfg. Co., Denver, Colo.
Traylor Eng. & Mfg. Co., Allentown, Pa.—rotary.—see page 142
Vulcan Iron Works, Wilkes-Barre, Pa.—see page 153
Weller Mfg. Co., Chicago, Ill.—see page 134
Worthington Pump & Machinery Corp., New York, N. Y.

LABORATORY EQUIPMENT

Eimer & Amend, New York, N. Y.
Riehle Testing Machine Co., Philadelphia, Pa.
Sturtevant Mill Co., Boston, Mass.—see page 163
Central Scientific Materials Co., Chicago, Ill.

LIME HANDLING EQUIPMENT

J. R. Alsing Engineerng Co., New York, N. Y.
Jeffrey Mfg. Co., Columbus, O.—see page 24-25
Link-Belt Co., Chicago, Ill.—see page 122 and back cover
Webster Mfg. Co., Chicago, Ill.—see page 126-127
Weller Mfg. Co., Chicago, Ill.—see page 134

LIME AND HYDRATING PLANTS

Arnold & Weigel, Woodville, O.
Glamorgan Pipe & Foundry Co., Lynchburg, Va.
H. Miscampbell, Duluth, Minn.—see page 138
McGann Mfg. Co., Inc., York, Pa.—see page 116
Richard K. Meade & Co., Baltimore, Md.—see page 166
Schaffer Engineering & Equipment Co., Pittsburgh, Pa.—lime—see inside front cover
Steacy-Schmidt Mfg. Co., New York, N. Y.

LIME PACKERS

Valve Bag Co. of America, Toledo, O.—see page 4-5
S. Howes Co., Silver Creek, N. Y.

LOADERS—UNLOADERS

Atlas Engineering Co., Milwaukee, Wis.
Austin Machinery Corp., Toledo, O.—wagon
Barber-Greene Co., Aurora, Ill.
Bay City Dredge Works, Bay City, Mich.
Bay City Foundry & Machine Co., Bay City, Mich.
Brown Hoisting Machinery Co., Cleveland, O.—see page 1
Burch Plow Works, Crestline, O.
The Byers Machine Co., Ravenna, O.—car and wagon.—see page 167
Erie Steam Shovel, Erie, Pa.—see page 161
Fairmont Mining Machinery Co., Fairmont, W. Va.
The Galion Iron Works & Mfg. Co., Galion, O.
Gifford-Wood Co., Hudson, N. Y.
The Good Roads Machinery Co., Inc., Kennett Square, Pa.—see page 135
The Geo. Haiss Mfg. Co., New York, N. Y.—all kinds.—see page 158
The Hamilton Mfg. Co., Columbus, O.
Hoar Shovel Co., Duluth, Minn.—see page 119
Holly Pneumatic Systems, Inc., New York, N. Y.—pneumatic
Industrial Works, Bay City, Mich.—see page 161
The Jeffrey Mfg. Co., Columbus, O.—see page 24-25
Lake Superior Loader Co., Duluth, Minn.—underground
Lee Trailer & Body Co., Chicago, Ill.
Link-Belt Co., Chicago, Ill.—all types.—see page 122 and back cover
Manierre Engineering & Machinery Co., Milwaukee, Wis.
McKinney-Harrington Co., North Chicago, Ill.
Meese & Gottfried, San Francisco, Calif.
Myers-Whaley Co., Knoxville, Tenn.
National Conveying Equipment Corp., Chicago, Ill.
National Iron Co., Duluth, Minn.
Northern Conveyor & Mfg. Co., Milwaukee, Wis.
Orton & Steinbrenner Co., Chicago, Ill.—see page 136

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Ottumwa Box Car Loader Co., Ottumwa, Ia.—box car
Portable Machinery Co., Passaic, N. J.
Robins Conveying Belt Co., New York, N. Y.—see page 26
Robins Engineering Co., Chicago, Ill.
Schaffer Eng. & Equip. Co., Pittsburgh, Pa.—car loaders, see inside front cover
James B. Seaverns, Chicago, Ill.
The Security Engineering Sales Co., Duluth, Minn.—log
T. L. Smith, Milwaukee, Wis.
Specialty Engineering Co., Philadelphia, Pa.—chain and bucket type
Stiles Mfg. Co., Bolivar, Mo.
The Sunbury Mfg. Co., Sunbury, O.
Thew Shovel Co., Lorain, O.—see page 31
Universal Road Machinery Co., Kingston, N. Y.—see page 149
Webster Mfg. Co., Chicago, Ill.—see page 126-127
Weller Mfg. Co., Chicago, Ill.—see page 134

LOCOMOTIVES (Compressed Air)

H. K. Porter Co., Pittsburgh, Pa.

LOCOMOTIVES (Electric and Storage Battery)

American Locomotive Co., New York, N. Y.
Atlas Car & Mfg. Co., Cleveland, O.—see page 160
Baldwin Locomotive Works, Philadelphia, Pa.—see page 153
Davidson Equipment Co., O. H., Denver, Colo.
M. K. Frank, Pittsburgh, Pa.
General Electric Co., Shenectady, N. Y.
Goodman Mfg. Co., Chicago, Ill.
The Industrial Equipment Co., Minster, O.
The Ironton Engine Co., Ironton, O.
The Jeffrey Mfg. Co., Columbus, O.—see page 24-25
Mancha Storage Battery Locomotive Co., St. Louis, Mo.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.
Geo. D. Whitcomb, Rochelle, Ill.—see page 164

LOCOMOTIVES (Gasoline)

Adamson Motor Co., Birmingham, Ala.
American Locomotive Co., New York, N. Y.
The Atlas Car & Mfg. Co., Cleveland, O.—see page 160
Austin Machinery Corp., Toledo, O.
Baldwin Locomotive Works, Philadelphia, Pa.—see page 153
Brookville Truck & Tractor Co., Brookville, Pa.
Davenport Locomotive Co., Davenport, Ia.
Easton Car & Construction Co., Easton, Pa.—see page 159
The Fate-Root-Heath Co., Plymouth, O.—Plymouth.—see page 10-11
Hadfield-Penfield Steel Co., Bucyrus, O.—see page 152
Industrial Equipment Co., Minster, O.
Koppel Industrial Car & Equipment Co., Koppel, Pa.
Milwaukee Locomotive Mfg. Co., Milwaukee, Wis.
Geo. D. Whitcomb Co., Rochelle, Ill.—see page 164
Vulcan Iron Works, Wilkes-Barre, Pa.—see page 153

LOCOMOTIVES (Steam)

American Locomotive Co., New York, N. Y.
Baldwin Locomotive Works, Philadelphia, Pa.—see page 153
Birmingham Rail & Locomotive Co., Birmingham, Ala.
Davenport Locomotive Works, Davenport, Ia.
Geo. H. Heisler Co., Erie, Pa.
Lima Locomotive Works, Lima, O.—see page 152
H. K. Porter Co., Pittsburgh, Pa.
Vulcan Iron Works, Wilkes-Barre, Pa.—see page 153
Geo. D. Whitcomb Co., Rochelle, Ill.—see page 164

LOG WASHERS

Allis-Chalmers Mfg. Co., Milwaukee, Wis.—see page 14-15
Dings Magnetic Separator Co., Milwaukee, Wis.—magnetic
Joshua Hendy Iron Works, San Francisco, Calif.
Magnetic Mfg. Co., Milwaukee, Wis.—see page 8
McLanahan Stone Machine Co., Hollidaysburg, Pa.—see page 163
Worthington Pump & Machinery Corp., New York, N. Y.

LUBRICANTS (Oils and Greases)

Colonial Supply Co., Pittsburgh, Pa.
Adam Cook's Sons Co., New York, N. Y.—see page 166
Fiske Bros. Refining Co., New York, N. Y.
Indian Refining Co., New York, N. Y.
Ironsides Co., Columbus O.—wire rope and gear
Keystone Lubricating Co., Philadelphia, Pa.
A. Leschen & Sons Co., St. Louis, Mo.—wire rope—see inside back cover
Robins Conveying Belt Co., New York, N. Y.—see page 26
Standard Oil Co., Chicago, Ill.
The Texas Company, New York, N. Y.
Vacuum Oil Co., New York, N. Y.

It was Roosevelt who said that every man owed some time to the development of the industry to which he was devoted. Many producers subscribe for ROCK PRODUCTS for their superintendents and suggest to their contemporaries that ROCK PRODUCTS is the journal they should read.

LUBRICATING SYSTEMS

S. F. Bowser & Co., Inc., Ft. Wayne, Ind.—automatic
Keystone Lubricating Co., Philadelphia, Pa.
Wayne Oil Tank & Pump Co., Ft. Wayne, Ind.

LUBRICATORS

S. F. Bowser & Co., Inc., Ft. Wayne, Ind.
Keystone Lubricating Co., Philadelphia, Pa.

MACHINE SHOP EQUIPMENT

The Black & Decker Mfg. Co., Baltimore, Md.
Champion Blower & Forge Co., Lancaster, Pa.
Manning, Maxwell & Moore, Inc., New York, N. Y.
Moore & Moore, Reading, Pa.
Sullivan Machinery Co., Chicago, Ill.

MAGAZINES (Storage, Portable)

Littleford Bros., Cincinnati, O.

MAGNETIC DEVICES

Pulleys, Separators, Drums, Concentrators, Safety Magnets, Magnetic Spouts, Special Magnets
C. G. Buchanan Co., New York, N. Y.—see page 140
Cutler-Hammer Mfg. Co., Milwaukee, Wis.—clutches, pulleys, starters, etc.
Dings Magnetic Separator Co., Milwaukee, Wis.
Electric Controller & Mfg. Co., Cleveland, O.
Magnetic Mfg. Co., Milwaukee, Wis.—see page 8

MANGANESE STEEL

American Manganese Steel Co., Chicago Heights, Ill.—see page 156
Hadfield-Penfield Steel Co., Bucyrus, O.—see page 152
Inland Engineering Co., Chicago, Ill.—see page 164
Link-Belt Co., Chicago, Ill.—see page 122 and back cover
Manganese Steel Forge Co., Philadelphia, Pa.
Moore & Moore, Reading, Pa.
Taylor-Wharton Iron & Steel Co., High Bridge, N. J.—see page 133
Worthington Pump and Machinery Corp., New York, N. Y.

MANILA ROPE

Colonial Supply Co., Pittsburgh, Pa.
O. H. Davidson Equipment Co., Denver, Colo.
Filter Fabrics Co., Salt Lake City, Utah
C. W. Hunt & Co., Inc., W. New Brighton, N. Y.
Link-Belt Co., Chicago, Ill.—see page 122 and back cover
Meese & Gottfried Co., San Francisco, Calif.
Upson Walton Co., Cleveland, O.

MAN LIFTS

Bland Engineering Co., Minneapolis, Minn.—see page 151

MECHANICAL RUBBER GOODS

Badger Belt & Rubber Corp., Milwaukee Wis.
Cincinnati Rubber Mfg. Co., Cincinnati, O.
Goodrich Rubber Co., Akron, O.
Goodyear Rubber Co., Akron, O.
New York Belting & Packing Co., New York, N. Y.
Quaker City Rubber Co., Philadelphia, Pa.

MILLS (Grinding)

Abbe Engineering Co., New York, N. Y.—ball, tube and jar
Allis-Chalmers Mfg. Co., Milwaukee, Wis.—see page 14-15
J. R. Alsing Engineering Co., New York, N. Y.—ball, tube, pebble
American Pulverizer Co., St. Louis, Mo.—see page 22
Bradley Pulverizer Co., Allentown, Pa.
Brainard Pulverizer Co., Chicago, Ill.
Braun Corp., Los Angeles, Calif.
Butterworth & Lowe, Grand Rapids, Mich.—Buhr stone.—see page 162
Chalmers & Williams, Chicago Heights, Ill.—ball and tube
Colorado Iron Works, Denver, Colo.
The Denver Engineering Works Co., Denver, Colo.—ball and tube
J. B. Ehrsam & Sons Mfg. Co., Enterprise, Kans.—gypsum.—see page 124
Fuller-Lehigh Co., Fullerton, Pa.—ball, tube, etc.
Gruendler Pat. Crusher & Pulv. Co., St. Louis, Mo.—see page 118
Hardinge Co., New York, N. Y.—ball, conical
Joshua Hendy Iron Works, San Francisco, Calif.
K-B Pulverizer Co., Inc., New York, N. Y.—hammer.—see page 162
Kennedy-Van Saun Mfg. & Eng. Corp., New York, N. Y.—see page 130
Kent Mill Co., Brooklyn, N. Y.—see page 148
Mine & Smelter Supply Co., New York, N. Y.
Munson Mill Machinery Co., Inc., Utica, N. Y.—Buhr stone.—see page 149
Raymond Bros. Impact Pulv. Co., Chicago, Ill.—see page 128
F. L. Smidth & Co., New York, N. Y.—see page 23
Steacy-Schmidt Mfg. Co., New York, N. Y.
Stearns-Roger Mfg. Co., Denver, Colo.
E. H. Stroud & Co., Chicago, Ill.

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W. Toepfer & Sons Co., Milwaukee, Wis.—see page 139
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Williams Patent Crusher and Pulverizer Co., St. Louis, Mo.—see page 132

MIXERS

Abbe Engineering Co., New York, N. Y.
The American Cement Machine Co., Inc., Keokuk, Iowa.—concrete
Blystone Mfg. Co., Cambridge Springs, Pa.—concrete
Chain Belt Co., Milwaukee, Wis.—concrete.—see page 3
J. B. Ehrsam & Sons Mfg. Co., Enterprise Kans.—see page 124
Lakewood Engineering Co., Cleveland, O.—concrete
Manning, Maxwell & Moore, Inc., New York, N. Y.
T. L. Smith Co., Milwaukee, Wis.—concrete
Sturtevant Mill Co., Boston, Mass.—see page 163
L. V. Thayer, New York, N. Y.—concrete
Union Engineering Co., Cleveland, O.—concrete

MOTORS AND GENERATORS
(See Electric Motors, etc.)

MOTOR TRUCKS

Acme Motor Truck Co., Cadillac, Mich.
American Steam Truck Co., Chicago, Ill.
O. Armleder Co., Cincinnati, O.
Autocar Co., Ardmore, Pa.
Clark Tructractor Co., Chicago, Ill.
Columbia Motor Truck Co., Pontiac, Mich.
Commercial Truck Co., Philadelphia, Pa.
Diamond T Motor Car Co., Chicago, Ill.
Federal Motor Truck Co., Detroit, Mich.
Four Wheel Drive Auto Co., Clintonville, Wis.—3 T. with power dump body
The Garford Motor Truck Co., Lima, O.
General Motors Truck Co., Pontiac, Mich.
Gramm-Bernstein Motor Truck Co., Lima, O.
International Motor Co., New York, N. Y.
Lee Trailer & Body Co., Chicago, Ill.—trailers
Lewis-Hall Motors Corp., Detroit, Mich.
The Nash Motors Co., Kenosha, Wis.
The Packard Motor Car Co., Detroit, Mich.
Pierce Arrow Motor Car Co., Buffalo, N. Y.
Republic Truck Sales Corp., Alma, Mich.
Service Motor Truck Co., Wabash, Ind.
Sterling Motor Truck Co., Milwaukee, Wis.
Titian Motor Truck Co., Milwaukee, Wis.
Traffic Motor Truck Co., St. Louis, Mo.
Traylor Eng. & Mfg. Co., Allentown, Pa.—see page 142
The White Co., Cleveland, O.
Winthers Motors, Inc., Kenosha, Wis.
U. S. Motor Truck Co., Covington, Ky.

OIL
(See Lubricants)

OIL BURNERS

Aeroil Burner Co., Inc., Union Hill, N. J.
Kennedy-Van Saun Mfg. & Eng. Co., New York, N. Y.—see page 130
W. N. Best Furnace & Burner Corp., New York, N. Y.—see inside back cover

OIL ENGINES
See Engines

PACKINGS

The Booth Felt Co., Inc., Chicago, Ill.
The Cincinnati Rubber Mfg. Co., Cincinnati, O.
Colonial Supply Co., Pittsburgh, Pa.
Crane Co., Chicago, Ill.
Empire Tire & Rubber Corp., Chicago, Ill.—rubber
B. F. Goodrich Rubber Co., Akron, O.—all kinds
The Goodyear Tire & Rubber Co., Inc., Akron, O.
The Graton & Knight Mfg. Co., Worcester, Mass.—leather
Greene, Tweed & Co., New York, N. Y.
The Manhattan Rubber Mfg. Co., Chicago, Ill.—rubber
Manning, Maxwell & Moore, Inc., New York, N. Y.
N. Y. Belting & Packing Co., New York, N. Y.
New York Rubber Co., New York, N. Y.—all kinds
Quaker City Rubber Co., Philadelphia, Pa.
The Republic Rubber Co., Youngstown, O.—sheet
W. H. Salisbury & Co., Inc., Chicago, Ill.
United States Rubber Co., New York, N. Y.

PACKING MACHINERY

Bates Valve Bag Co., Chicago, Ill.—see page 18-19
Western Valve Bag Co., Chicago, Ill.
Modern Valve Bag Co., Trenton, N. J.
J. B. Ehrsam & Sons Co., Enterprise, Kans.—see page 124

A good many hundreds of dollars have been spent to bring this big Review and Directory Number to you. This directory feature alone will serve scores of buyers when they want the right name at the right time. Place this number where it never will get out of your sight and do not fail to say "ROCK PRODUCTS" when writing the manufacturers.

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Bland Engineering Co., Minneapolis, Minn.—see page 151
MacDonald Engineering Co., Chicago, Ill.
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Hadfield-Penfield Steel Co., Bucyrus, O.—see page 152
Lewistown Foundry & Machine Co., Lewistown, Pa.—wet and dry.—see page 129
Jackson & Church, Saginaw, Mich.
The Stevenson Co., Wellsville, O.

PAPER (For Lining Cars)

Cleveland-Akron Bag Co., Cleveland, O.—rosin sized sheeting and rag

PERFORATED METAL

Allis-Chalmers Mfg. Co., Milwaukee, Wis.—see page 14-15
Chicago Perforating Co., Chicago, Ill.
Cross Engineering Co., Carbondale, Pa.—see page 165
Harrington & King Perforating Co., Chicago, Ill.—see page 165
Hendrick Mfg. Co., Carbondale, Pa.—see page 125
Johnston & Chapman Co., Chicago, Ill.
Link-Belt Co., Chicago, Ill.—see page 122 and back cover
Nortmann-Duffke Co., Milwaukee, Wis.
Pittsburgh Perforating Co., Pittsburgh, Pa.
W. Toepfer & Sons Co., Milwaukee, Wis.—see page 139
Rogers Foundry & Machine Co., Joplin, Mo.
Webb City and Carterville Foundry & Machine Works, Webb City, Mo.—see page 165
Webster Mfg. Co., Chicago, Ill.—see page 126-127
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PIGMENTS

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PILE DRIVERS

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The Byers Machine Co., Ravenna, O.—see page 167
J. S. Mundy Hoisting Engine Co., Newark, N. J.—see page 167

PIPE

American Car & Foundry Co., Chicago, Ill.
American Rolling Mill Co., Middletown, O.—Armco ingot
American Spiral Pipe Works, Chicago, Ill.—spiral riveted
The Biggs Boiler Works Co., Akron, O.—steel riveted
Blaw-Knox Co., Pittsburgh, Pa.—see page 158
A. M. Byers Co., Pittsburgh, Pa.
Colonial Supply Co., Chicago, Ill.
Continental Pipe Mfg. Co., Seattle, Wash.—wood
Crane Co., Chicago, Ill.
L. B. Foster Co., Inc., Pittsburgh, Pa.
Glamorgan Pipe & Foundry Co., Lynchburg, Va.—cast iron
Hendrick Mfg. Co., Carbondale, Pa.—see page 125
Joshua Hendy Iron Works, San Francisco, Calif.
The Petroleum Iron Works Co. of Ohio, Sharon, Pa.
Traylor Engineering & Mfg. Co., Allentown, Pa.—see page 142
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PIPE SLEEVES
See Dredge Sleeves

PLASTER MACHINERY

Butterworth & Lowe, Grand Rapids, Mich.—see page 162
J. B. Ehrsam & Sons Mfg. Co., Enterprise, Kans.—see page 124
Union Engineering Co., Cleveland, O.

PLATES (Steel)

Biehl Iron Works, Inc., Reading, Pa.
Blaw-Knox Co., Pittsburgh, Pa.—see page 158
Central Frog & Switch Co., Cincinnati, O.—see page 167
Chicago Bridge & Iron Co., Chicago, Ill.
Duff Patents Co., Inc., Pittsburgh, Pa.
L. B. Foster Co., Pittsburgh, Pa.—tie
Fuller-Lehigh Co., Fullerton, Pa.—all kinds
Littleford Bros., Cincinnati, O.
The Reeves Bros. Co., Alliance, O.
Steacy-Schmidt Mfg. Co., New York, N. Y.
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Godfrey Conveyor Co., Elkhart, Ind.
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Portable Machinery Co., Passaic, N. Y.
Robins Conveying Belt Co., New York, N. Y.—see page 26
Specialty Engineering Co., Philadelphia, Pa.

POWER LINE RACK (Portable)

France Fdry. & Mach. Co., Toledo, O.

PRECIPITATION EQUIPMENT (Electrical)

Western Precipitation Co., Los Angeles, Calif.

PULLEYS

C. G. Buchanan, Inc., New York, N. Y.—see page 140
W. E. Caldwell Co., Louisville, Ky.—friction clutch
Colonial Supply Co., Pittsburgh, Pa.
R. & J. Dick Co., Inc., Passaic, N. J.—steel split
Dodge Mfg. Corp., Mishawaka, Ind.
Hesse-Ersted Iron Works, Portland, Ore.
The Hill Clutch Co., Cleveland, O.
W. A. Jones Fdry. & Machine Co., Chicago, Ill.—friction clutch
Link-Belt Co., Chicago, Ill.—see page 122 and back cover
Manning, Maxwell & Moore, Inc., New York, N. Y.
The Medart Co., St. Louis, Mo.
Meese & Gottfried Co., San Francisco, Calif.
Munson Mill Machine Co., Utica, N. Y.—see page 149
O. K. Clutch & Machinery Co., Columbia, Pa.
Philip Pressed Steel Pulley Works, Philadelphia, Pa.
Plamondon Mfg. Co., Chicago, Ill.
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PULVERIZED COAL SYSTEMS

Aero Pulverizer Co., New York, N. Y.
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American Pulverizer Co., St. Louis, Mo.—see page 22
The Bonnot Co., Canton, O.
Combustion Engineering Corp., New York, N. Y.
Fuller-Lehigh Co., Fullerton, Pa.
Grindle Fuel Equipment Co., Harvey, Ill.
Hardinge Co., New York, N. Y.
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Raymond Bros. Impact Pulv. Co., Chicago, Ill.—see page 128
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Ruggles-Coles Engineering Co., New York, N. Y.
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E. H. Stroud & Co., Chicago, Ill.
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Weller Mfg. Co., Chicago, Ill.—see page 134
The Youngstown Boiler & Tank Co., Youngstown, O.

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Abbe Engineering Co., New York, N. Y.
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J. R. Alsing Engineering Co., New York, N. Y.
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The C. O. Bartlett & Snow Co., Cleveland, O.
The Bonnot Co., Canton, O.
Bradley Pulverizer Co., Allentown, Pa.
Brainard Pulverizer Co., Chicago, Ill.
Bethlehem Steel Co., Bethlehem, Pa.—steel dredging
Dixie Machinery Mfg. Co., St. Louis, Mo.
Fuller-Lehigh Co., Fullerton, Pa.
Gruendler Pat. Crusher & Pulv. Co., St. Louis, Mo.—ring roll.—see page 118
Hardinge & Co., New York, N. Y.
Alfred Herbert, Ltd., Coventry, England.—coal
The Jeffrey Mfg. Co., Columbus, O.—see page 24-25
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K-B Pulverizer Co., New York, N. Y.—"Pulverburner," all kinds, see page 162
Kennedy-Van Saun Mfg. & Eng. Corp., New York, N. Y.—roll hammer, ring roll, combination ball tube mills, ball mills, air-swept tube mills for coal, rock or clinker, see page 130
Kent Mill Co., Brooklyn, N. Y.—see page 148
Pennsylvania Crusher Co., Philadelphia, Pa.—see page 167
Munson Mill Machinery Co., Utica, N. Y.—see page 149
New Holland Machine Co., New Holland, Pa.—see page 162
Raymond Bros. Impact Pulv. Co., Chicago, Ill.—see page 128
Stearns-Roger Mfg. Co., Denver, Colo.
E. H. Stroud and Co., Chicago, Ill.

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Universal Road Machinery Co., Kingston, N. Y.—see page 149
Weller Mfg. Co., Chicago, Ill.—see page 134
Williams Patent Crusher & Pulv. Co., St. Louis, Mo.—see page 132
Worthington Pump & Machinery Corp., New York, N. Y.

PUMPS

Advance Pump & Compressor Co., Battle Creek, Mich.—centrifugal, power and steam.
Aldrich Pump Co., Allentown, Pa.
Allis-Chalmers Mfg. Co., Milwaukee, Wis.—air, slurry and centrifugal, see pages 14-15
American Air Compressor Works, Brooklyn, N. Y.—vacuum
American Manganese Steel Co., Chicago Heights, Ill.—dredging, sand and gravel, see page 156
American Steam Pump Co., Battle Creek, Mich.
The American Well Works, Aurora, Ill.—centrifugal, etc.
Aurora Pump & Mfg. Co., Aurora, Ill.—deep well and turbine
The Barnes Mfg. Co., Mansfield, O.
Buffalo Steam Pump Co., Buffalo, N. Y.
Chicago Pneumatic Tool Co., Mansfield, O.
Colorado Iron Wks., Denver, Colo.
Connersville Blower Co., Connersville, Ind.
O. H. Davidson Equipment Co., Denver, Colo.
De Laval Steam Turbine Co., Trenton, N. J.—centrifugal
Edson Mfg. Corporation, Boston, Mass.—diaphragm
Ellicott Machine Corp., Baltimore, Md.—dredging, see page 163
The Emerson Pump & Valve Co., Alexandria, Va.—steam, see page 156
Erie Pump & Engine Works, Medina, N. Y.—centrifugal dredging
Evinrude Motor Co., Milwaukee, Wis.—centrifugal, high pressure 1½-2 inch, see page 116
Exeter Machine Works, Inc., W. Pittston, Pa.
Fairbanks, Morse & Co., Chicago, Ill.—centrifugal, piston and plunger
Fairmont Mining Machinery Co., Fairmont, W. Va.
Gilbert & Barker Mfg. Co., Springfield, Mass.—gas and oil
Glamorgan Pipe & Foundry Co., Lynchburg, Va.—centrifugal
Groch Centrifugal Floatation Co., El Paso, Texas
Hadfield-Penfield Steel Co., Bucyrus, O.—see page 152
Ingersoll-Rand Co., New York, N. Y.—centrifugal and direct-acting, see page 131
Jackson Byron Iron Works, Inc., San Francisco, Calif.
Kansas City Hay Press & Tractor Co., Kansas City, Mo.—sand and dredging, see page 121
Krogh Pump & Machinery Co., San Francisco, Calif.—centrifugal sand
Lansing Motor & Pump Co., Inc., Lansing, Mich.
Manning, Maxwell & Moore, Inc., New York, N. Y.
Meese & Gottfried Co., San Francisco, Calif.—centrifugal
Morris Machine Co., Baldwinsville, N. Y.—see page 160
F. E. Myers & Bros. Co., Ashland, O.—all kinds
The Norbon Engineering Co., Darby Pa.—dredge
Novo Engine Co., Lansing, Mich.—centrifugal, diagraph, deep-well
Nye Steam Pump & Mach. Corp., Chicago, Ill.
Pittsburgh Mining Machinery Co., Pittsburgh, Pa.
Pneumelectric Corp., Syracuse, N. Y.
Pulsometer Steam Pump Co., New York, N. Y.—steam
Schramm, Inc., West Chester, Pa.—compressor
F. L. Smidth & Co., New York, N. Y.—slurry, see page 23
Sullivan Machinery Co., Chicago, Ill.
The Superheater Co., New York, N. Y.
Swaby Mfg. Co., Chicago, Ill.—centrifugal, others
Swintek Traveling Suction Screen Nozzle Co., Eddyville, Ia., see page 12
Taylor-Wharton Iron & Steel Co., High Bridge, N. J.—centrifugal sand, see page 133
Traylor Engineering & Mfg. Co., Allentown, Pa.—see page 142
United Lead Co., New York, N. Y.
Webb City & Carterville Fdry. & Machine Works, Webb City, Mo.—centrifugal, see page 165
Weinman Pump Co., Columbus, O.—centrifugal
Western Pump Co., Davenport, Ia.
Worthington Pump & Mach. Corp., New York, N. Y.—power, centrifugal, steam and electric

PYROMETERS—THERMOMETERS—TACHOMETERS
(Indicating and Recording)

Bristol Co., Waterbury, Conn.
The Brown Instrument Co., Philadelphia, Pa.
Cleveland Instrument Co., Cleveland, O.
The Leeds & Northrup Co., Philadelphia, Pa.
Taylor Instrument Co., Rochester, N. Y.
Thwing Instrument Co., Philadelphia, Pa.
Wilson-Maeulen Co., New York, N. Y.

RECEIVERS—Air

The Brownell Co., Dayton, O.
The Bury Compressor Co., Erie, Pa.
Chicago Pneumatic Tool Co., New York, N. Y.
Ingersoll-Rand Co., New York, N. Y.—see page 131
Worthington Pump & Machinery Corp., New York, N. Y.

REFRACTORIES
(See Fire Brick)

Wahl Refractory Products Co., Freemont, O.—see page 146
Celite Products Co., Chicago, Ill.—see front cover

RELAYING RAILS

L. B. Foster Co., Inc., Pittsburgh, Pa.
M. K. Frank, Pittsburgh, Pa.
Hyman-Michaels Co., Chicago, Ill.

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RIMS—Traction

Foley Traction Rim Co., Minneapolis, Minn.

ROAD MACHINERY—Rollers, Graders, Spreaders, Planers and Plows

Austin Manufacturing Co., Chicago, Ill.—see page 150
The Austin Western Road Machinery Co., Chicago, Ill.—see page 150
The Burch Plow Works Co., Crestline, O.
The Galion Iron Works & Mfg. Co., Galion, O.
Good Roads Machinery Co., Kennett Square, Pa.—see page 135
Manning, Maxwell & Moore, Inc., New York, N. Y.
Ruggles-Coles Eng. Co., New York, N. Y.
Sanford-Day Iron Works, Knoxville, Tenn.
The Sunbury Mfg. Co., Sunbury, O.
Traylor Eng. & Mfg. Co., Allentown, Pa.—see page 142
Universal Road Machinery Co., Kingston, N. Y.—see page 149
Western Wheeled Scraper Co., Aurora, Ill.

ROOFING AND SIDING MATERIAL

American Rolling Mill Co., Middletown, O.—Armco ingot iron
Illinois Zinc Co., Chicago, Ill.
H. H. Robertson Co., Pittsburgh, Pa.
Newport Rolling Mill Co., Newport, Ky.

SAFETY DEVICES—Goggles, Respirators, Etc.

Chicago Eye Shield Co., Chicago, Ill.
Cleveland Railway Supply Co., Cleveland, O.
Colonial Supply Co., Pittsburgh, Pa.
Foamite-Childs Corp., Utica, N. Y.
Mine Safety Appliances Co., Pittsburgh, Pa.
Pulmosan Safcty Equipment Co., Brooklyn, N. Y.
Safety First Supply Co., Pittsburgh, Pa.
Willson Goggles, Inc., Reading, Pa.

SAND CONES

Allen Cone Co., El Paso, Texas
Greenville Mfg. Co., Greenville, O.—see page 154
Link-Belt Co., Chicago, Ill.—see page 122 and back cover
Smith Eng. Works, Milwaukee, Wis.—see page 155
Stephens-Adamson Mfg. Co., Aurora, Ill.

SAND GRINDING PANS

Lewistown Fdry. & Mach. Corp., Lewistown, Pa.—see page 129

SAND TANKS

Allen Cone Co., El Paso, Texas
Greenville Mfg. Co., Greenville, O.—see page 154
Smith Engineering Works, Milwaukee, Wis.—see page 155
W. Toepfer & Sons Co., Milwaukee, Wis.—see page 139

SCALES

Automatic Weighing Machine Co., New York City, N. Y.
Fairbanks, Morse & Co., Chicago, Ill.—all types
C. W. Hunt & Co., W. New Brighton, N. Y.
Merrick Scale Mfg. Co., Passaic, N. J.—automatic, conveyor, weightometers
Richardson Scale Co., Passaic, N. J.—automatic weighing and proportioning, see page 151
Schaefer Engineering & Equipment Co., Pittsburgh, Pa.—see inside front cover
Strait Scale Co., Kansas City, Mo.
Sturtevant Mill Co., Boston, Mass.—hopper and bagging, see page 163
Winslow Government Standard Scale Wks., Inc., Terre Haute, Ind.

SCRAPERS

The Austin Western Road Machinery Co., Chicago, Ill.—dump and wheeled, see page 150
Baker Mfg. Co., Springfield, Ill.
Beach Mfg. Co., Charlotte, Mich.
R. H. Beaumont Co., Philadelphia, Pa.—cable drag
L. P. Green, Chicago, Ill.—drag
Link-Belt Co., Chicago, Ill.—drag, see pages 122 and back cover
Manning, Maxwell & Moore, Inc., New York, N. Y.
Sauerman Bros., Chicago, Ill.—drag and bottomless power, see page 157
Schofield-Burkett Construction Co., Macon, Ga.
The Sunbury Mfg. Co., Sunbury, O.
Western Wheeled Scraper Co., Aurora, Ill.—wheeled and drag

SCREEN NOZZLES

Swintek Traveling Suction Screen Co., Eddyville, Ia.—cutterhead, see page 12

SCREENS

Allis-Chalmers Mfg. Co., Milwaukee, Wis.—revolving, shaking, conical, see pages 14-15

Audubon Wire Cloth Co., Inc., Audubon, N. J.
Austin Manufacturing Co., Chicago, Ill.—see page 150
Austin-Western Road Machinery Co., Chicago, Ill.—see page 150
Earle C. Bacon, Inc., New York, N. Y.—see page 28
The C. O. Bartlett & Snow Co., Cleveland, O.
C. G. Buchanan Co., Inc., New York, N. Y.—revolving, see page 140
Buffalo Wire Works, Buffalo, N. Y.
C. S. Card Iron Works Co., Denver, Colo.
Chain Belt Co., Milwaukee, Wis.—revolving, shaking, gravity, see page 3
Chalmers & Williams, Chicago Heights, Ill.—pulsating, revolving
The Cleveland Wire Cloth & Mfg. Co., Cleveland, O.—see page 165
Colorado Iron Works, Denver Colo.—vibrating
Coyle & Roth, Minneapolis, Minn.
Cross Engineering Co., Carbondale, Pa.—see page 165
The Denver Engineering Works Co., Denver, Colo.—revolving
Dodge Mfg. Co., Mishawaka, Ind.—bar and trommel
J. B. Ehrsam & Sons Mfg. Co., Enterprise, Kan.—see page 124
Exeter Machine Works, Inc., West Pittston, Pa.
Fairmont Mining Machinery Co., Fairmont, W. Va.
Galion Iron Works, Galion, O.
Good Roads Machinery Co., Inc., Kennett Square, Pa.—revolving, shaking, see page 135
Greenville Mfg. Co., Greenville, O.—all types, see page 154
Gruendler Pat. Crusher & Pulverizer Co., St. Louis, Mo.—revolving, vibrating, see page 118
The Geo. Haiss Mfg. Co., New York, N. Y.—see page 158
Hardinge Co., New York, N. Y.
Harrington & King Perforating Co., Chicago, Ill.—see page 165
Hendrick Mfg. Co., Carbondale, Pa.—revolving and shaking, see page 125
Joshua Hendy Iron Works, San Francisco, Calif.
Hesse-Ersted Iron Works, Portland, Ore.—revolving
The Jeffrey Mfg. Co., Columbus, O.—shaking, see pages 24-25
Johnston & Chapman Co., Chicago, Ill.—cylindrical and conical
Kennedy-Van Saun Mfg. & Eng. Corp., New York City, N. Y.—revolving, gravity, pulsating, Maxton, conical, see page 130
Kent Mill Co., Brooklyn, N. Y.—vibrating and hexagonal revolving, see page 148
Lewistown Foundry & Machine Co., Lewistown, Pa.—see page 129
Link-Belt Co., Chicago, Ill.—all kinds, see pages 122 and back cover
Littleford Bros., Cincinnati, O.
Ludlow-Saylor Wire Co., St. Louis, Mo.
McLanahan-Stone Machine Co., Hollidaysburg, Pa.—all kinds, see page 163
Meese & Gottfried Co., San Francisco, Calif.—cylindrical
National Engineering Co., Chicago, Ill.—vibrating
Newark Wire Cloth Co., Newark, N. J.
Nortmann-Duffke Co., Milwaukee, Wis.
The Orville Simpson Co., Cincinnati, O.—rotex, vibrating and shaking, see page 17
Pittsburgh Perforating Co., Pittsburgh, Pa.—metal
Robins Conveying Belt Co., New York, N. Y.—see page 26
Rogers Foundry & Mfg. Co., Joplin, Mo.
Schaffer Engineering & Equipment Co., Pittsburgh, Pa.—see inside front cover
James B. Seaverns, Chicago, Ill.—shaking, vibrating, revolving
Simplex Screen Co., Salt Lake City, Utah
Smith Engineering Works, Milwaukee, Wis.—see page 155
Southwestern Engineering Co., Los Angeles, Calif.—vibrating
The Stearns Conveyor Co., Cleveland, O.
Stephens-Adamson Mfg. Co., Aurora, Ill.
Stevenson Co., Wellsville, O.
Stimson Equip. Co., Salt Lake City, Utah—electrical vibrating
Sturtevant Mill Co., Boston, Mass.—round, hexagonal, vibrating, see page 163
Swintek Traveling Suction Screen Co., Eddyville, Ia., see page 12
Taylor-Wharton Iron & Steel Co., High Bridge, N. J.—see page 133
W. Toepfer & Sons Co., Milwaukee, Wis.—revolving, see page 139
Traylor Eng. & Mfg. Co., Allentown, Pa.—see page 142
Twin City Iron & Wire Co., St. Paul, Minn.—wire, see page 167
The W. S. Tyler Co., Cleveland, O.—electrical vibrating and woven wire, see page 141
The Union Engineering Co., Cleveland, O.
Universal Crusher Co., Cedar Rapids, Ia.—see page 163
Universal Road Machinery Co., Kingston, N. Y.—see page 149
Universal Vibrating Screen Co., Racine, Wis.—see page 155
Webb City & Carterville Fdry. & Machine Works, Webb City, Mo.—trunnion and tromell, see page 165
Webster Mfg. Co., Chicago, Ill.—revolving and shaking, see page 126-127
Weller Mfg. Co., Chicago, Ill.—see page 134
Western Wheeled Scraper Co., Aurora, Ill.—revolving
Wickwire Spencer Steel Co., Worcester, Mass.
Williams Patent Crusher & Pulv. Co., St. Louis, Mo.—see page 132

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Worthington Pump & Machinery Corp., New York, N. Y.

SHEAVES

American Steel & Wire Co., Chicago, Ill.—see page 166
Baker Car Co., Harriman, Tenn.
C. S. Card Iron Works Co., Denver, Colo.
Clyde Iron Works, Duluth, Minn.
Conveyors Corp. of America, Chicago, Ill.
Dodge Mfg. Co., Mishawaka, Ind.
Godfrey Conveyor Co., Elknart, Ind.
The Geo. Haiss Mfg. Co., Inc., New York, N. Y. —see page 158
Joshua Hendy Iron Works, San Francisco, Calif.
The Hill Clutch Co., Cleveland, O.
Hockensmith Wheel & Mine Car Co., Penn, Pa.
Indiana Foundry Co., Inc., Indiana, Pa.
Inand Engineering Co., Chicago, Ill.—see page 164
Lake Shore Engine Works, Marquette, Mich.
Link-Belt Co., Chicago, Ill.—see page 122 and back cover
Medart Co., St. Louis, Mo.
Meese & Gottfried Co., San Francisco, Calif.
The Mining Machine Co., Mountville, Pa.—steel, see page 159
Newhall Chain Forge & Iron Co., New York, N. Y.
Ottumwa Iron Works, Ottumwa, Ia.—see page 146
Pettibone-Mulliken Co., Chicago, Ill.
Pittsburgh Mining Machinery Co., Pittsburgh, Pa.
John A. Roebling s Sons Co., Trenton, N. J.
Sanford-Day Iron Works, Knoxville, Tenn.
Schofield-Burkett Construction Co., Macon, Ga.
Vulcan Iron Works, Wilkes-Barre, Pa.—see page 153
The Webster Mfg. Co., Chicago, Ill.—see pages 126-127
Weller Mfg. Co., Chicago, Ill.—see page 134
Wellman-Seaver-Morgan Co., Cleveland, O.
Williamsport Wire Rope Co., Williamsport, Pa.

SHOVELS—Steam

American Hoist & Derrick Co., St. Paul, Minn.—steam, see page 163
Austin Machinery Corp., Toledo, O.—steam, gas and electric
Bay City Dredge Works, Bay City, Mich.
Brown Hoisting Machinery Co., Cleveland, O.—see page 1
Browning Co., Cleveland, O.—see page 137
Bucyrus Co., South Milwaukee, Wis.—all types, see page 166
Erie Steam Shovel Co., Erie, Pa.—see page 161
Hoar Shovel Co., Duluth, Minn.—see page 119
Industrial Works, Bay City, Mich.—combination crane-steam shovels—see page 161
Lake Superior Loader Co., Duluth, Minn.—compressed air
Link-Belt Co., Chicago, Ill.—power-automatic—see page 122 and back cover
The Marion Steam Shovel Co., Marion, O.—steam, gasoline, electric, revolving, etc., see page 32
Myers-Whaley Co., Knoxville, Tenn.
Northwest Engineering Co., Chicago, Ill.—gasoline, see insert
Orton & Steinbrenner, Chicago, Ill.—steam, see page 136
Osgood Co., Marion, O.—steam, see page 161
Pawling, Harneschfeger Co., Milwaukee, Wis.
The Thew Shovel Co., Lorain, O.—steam, gasoline and electric, see page 31

SKIPS

Allis-Chalmers Mfg. Co., Milwaukee, Wis.—see pages 14-15
American Hoist & Derrick Co., St. Paul, Minn.—see page 161
Atlas Car & Mfg. Co., Cleveland, O.—see page 160
Earle C. Bacon, Inc., New York, N. Y.—see page 28
C. O. Bartlett & Snow Co., Cleveland, O.
The Biehl Iron Works, Inc., Reading, Pa.
C. S. Card Iron Works Co., Denver, Colo.
Denver Engineering Works, Denver, Colo.
Joshua Hendy Iron Works, San Francisco, Calif.
Jeffrey Mfg. Co., Columbus, O.—see pages 24-25
Koppel Industrial Car & Equipment Co., Koppel, Pa
Lake Shore Engine Works, Marquette, Mich.
Link-Belt Co., Chicago, Ill.—see page 122 and back cover
Penn Foundry & Mfg. Co., Reading, Pa.
Stearns-Roger Mfg. Co., Denver, Colo.
Traylor Eng. & Mfg. Co., Allentown, Pa.—see page 142
Vulcan Iron Works, Wilkes-Barre, Pa.—see page 153
Webster Mfg. Co., Chicago, Ill.—see pages 126-127
Weller Mfg. Co., Chicago, Ill.—see pages 134

SLATE WORKING MACHINERY

S. Flory Mfg. Co., Bangor, Pa.—see page 147
Ruggles Machine Co., Poultney, Vt.
Sullivan Machinery Co., Chicago, Ill.

SPEED REDUCERS

The Cleveland Worm & Gear Co., Cleveland, O. —see page 145
Dodge Mfg. Co., Mishawaka, Ind.
Falk Corp., Milwaukee, Wis.
Foote Bros. Gear & Machine Co, Chicago, Ill.

Wm. Ganschow Co., Chicago, Ill.
D. O. James Manufacturing Co., Chicago, Ill.
W. A. Jones Fdry. & Machine Co., Chicago, Ill.
R. D. Nuttall Co., Pittsburgh, Pa.
Poole Eng. & Machine Co., Baltimore, Md.
Weller Mfg. Co., Chicago, Ill.—see page 134

SPROCKETS

American Manganese Steel Co., Chicago Heights, Ill.—see page 156
B. & W. Oil-less Conveyor Co., Chicago, Ill.
The Baldwin Chain & Mfg. Co., Worcester, Mass.
W. E. Caldwell Co., Louisville, Ky.
Chain Belt Co., Milwaukee, Wis.—see page 3
Dodge Mfg. Corp., Mishawaka, Ind.
Foote Bros. Gear & Machine Co., Chicago, Ill.
The Geo. Haiss Mfg. Co., Inc., New York, N. Y. —see page 158
Hesse-Ersted Iron Works, Portland, Ore.
Hill Clutch Co., Cleveland, O.
Howe Chain Co., Muskegon, Mich.
Inland Engineering Co., Chicago, Ill.—see page 164
The Jeffrey Mfg. Co., Columbus, O.—see pages 24-25
W. A. Jones Foundry & Machine Co., Chicago, Ill.
Link-Belt Co., Chicago, Ill.—see page 122 and back cover
The Medart Co., St. Louis, Mo.
Meese & Gottfried Co., San Francisco, Calif.
Morse Chain Co., Ithaca, N. Y.—silent chain, see pages 6-7
Pettibone Mulliken Co., Chicago, Ill.
Robins Conveying Belt Co., New York, N. Y.—see page 26
Stroh Steel-Hardening Process Co., Pittsburgh, Pa.
Taylor-Wharton Iron & Steel Co., High Bridge, N. J.—see page 133
Union Chain & Mfg. Co., Sandusky, O.
The Webster Mfg. Co., Chicago, Ill.—see pages 126-127
The Weller Mfg. Co., Chicago, Ill.—see page 134

STACKS

Allis-Chalmers Mfg. Co., Milwaukee, Wis.—see pages 14-15
The Biggs Boiler Works Co., Akron, O.
Chicago Bridge & Iron Co., Chicago, Ill.
Duff Patents Co., Inc., Pittsburgh, Pa.
Hendrick Mfg. Co., Carbondale, Pa.—see page 125
The Houston, Stanwood & Gamble Co., Inc., Cincinnati, O.
Pittsburgh-Des Moines Steel Co., Pittsburgh, Pa.
The Reeves Bros. Co., Alliance, O.
Standard Steel Works, North Kansas City, Mo.
Steacy-Schmidt Mfg. Co., York, Pa.
Traylor Engineering & Mfg. Co., Allentown, Pa. —see page 142

STEAM ENGINES

See Engines

STEAM SHOVEL REPAIR PARTS

American Manganese Steel Co., Chicago Heights, Ill.—see page 156
Hadfield-Penfield Steel Co., Bucyrus, O.—see page 152
Inland Engineering Co., Chicago, Ill.—see page 164
Moore and Moore, Inc., Reading, Pa.
Stroh Steel Hardening Co., Pittsburgh, Pa.
Taylor-Wharton Iron & Steel Co., High Bridge, N. J.—see page 133

STONE GRAPPLE

Superior Iron Works, Superior, Wis.

STONE SCRUBBERS

Allis-Chalmers Mfg. Co., Milwaukee, Wis.—see pages 14-15
Greenville Mfg. Co., Greenville, O.—see page 154
Link-Belt Co., Chicago, Ill.—see page 122 and back cover
Stephens-Adamson Mfg. Co., Aurora, Ill.
Smith Engineering Works, Milwaukee, Wis.—see page 155

STORAGE SYSTEM—Oil and Gas

S. F. Bowser & Co., Pittsburgh, Pa., Ft. Wayne, Ind.
Gilbert & Barker Mfg. Co., Springfield, Mass.
Wayne Tank & Pump Co., 797 Canal St., Ft. Wayne, Ind.

STRUCTURAL STEEL WORK

The Austin Co., Cleveland, O.
Blaw-Knox Co., Pittsburgh, Pa.—see page 158
Exeter Machine Works, Inc., West Pittston, Pa.
Gehret Bros., Inc., Bridgeport, Pa.
Henricks Mfg. Co., Carbondale, Pa.—see page 125
Penn Bridge Co., New York, N. Y.
Pittsburgh-Des Moines Steel Co., Pittsburgh, Pa.

STUCCO FACINGS

Crown Point Spar Co., Inc., New York, N. Y.
Greenstone Products Co., Roanoke, Va.
The Metro-Nite Co., Milwaukee, Wis.—see page 160
Middlebury Marble Co., Brandon, Vt.
Vermont Milling Products Corporation, Poultney, Vt.—granules, chips

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SUPERHEATERS

Power Specialty Co., New York, N. Y.—air heaters, fuel economizers
The Superheater Co., New York, N. Y.—locomotives, power plants, steam shovels

SWITCHES—Electrical

The Automatic Reclosing Circuit Breaker Co., Columbus, O.
Cutler-Hammer Mfg. Co., Milwaukee, Wis.
The Electric Controller & Mfg. Co., Cleveland, O.—automatic
General Electric Co., Schenectady, N. Y.
Ohio Brass Co., Mansfield, O.
Westinghouse Electric & Mfg. Co., E. Pittsburgh, Pa.

TANKS

American Spiral Pipe Works, Chicago, Ill.
Allen Cone Co., El Paso, Texas—dewatering, sand washing, thickening, etc.
The Biggs Boiler Works Co., Akron, O.—steel storage pressure, high pressure, mixing and agitating, steam jacksted, pneumatic water supply, air receivers, condensors, evaporators, coolers, hot water, lead lined, creosoting, surge and underground.
Blaw-Knox Co, Pittsburgh, Pa.—see page 158
S. F. Bowser Co., Inc., Fort Wayne, Ind.—for gasoline and oil
The Brownell Co., Dayton, O.
W. E. Caldwell Co., Louisville, Ky.—wood, steel and galvanized
Chicago Bridge & Iron Works, Chicago, Ill.
Columbian Steel Tank Co., Kansas City, Mo.
Conveyors Corp. of America, Chicago, Ill.
The Dorr Co., New York, N. Y.—see page 143
Duff Patents Co., Inc., Pittsburgh, Pa.
Erie City Iron Works, Erie, Pa.
Gilbert & Barker Mfg. Co., Springfield, Mass.
The Greenville Mfg. Co., Greenville, O.—steel, automatic and settling, see page 154
The Heil Co., Milwaukee, Wis.
Hendrick Mfg. Co., Carbondale, Pa.—see page 125
Littleford Bros., Cincinnati, O.
MacDonald Eng. Co., Chicago, Ill.—concrete
Manning, Maxwell & Moore, Inc., New York, N. Y.
McGann Manufacturing Co., Inc., York, Pa.—see page 116
Petroleum Iron Works Co. of Ohio, Sharon, Pa.—water
Pittsburgh-Des Moines Steel Co., Pittsburgh, Pa.
The Reeves Bros. Co., Alliance, O.
Smith Eng. Works, Milwaukee, Wis.—sand, see page 155
Standard Steel Works, North Kansas City, Mo.
Steacy-Schmidt Mfg. Co., New York, N. Y.
Stearns-Rogers Mfg. Co., Denver, Colo.
Sturtevant Mill Co., Boston, Mass.—see page 163
W. Toepfer & Sons Co., Milwaukee, Wis.—sand settling, see page 139
Traylor Eng. & Mfg. Co., Allentown, Pa.—see page 142
Walsh & Widner Boiler Co., Chattanooga, Tenn.
Wayne Tank & Pump Co., Ft. Wayne, Ind.—storage tanks
Weller Mfg. Co., Chicago, Ill.—see page 134
Wiederholdt Construction Co., New York, N. Y.
Youngstown Boiler & Tank Co., Youngstown, O.

TARPAULINS

Cleveland Akron Bag Co., Cleveland, O.

TESTING LABORATORIES

Robt. W. Hunt & Co., Chicago, Ill.—see page 166
Geo. Borrowman, Ph.D., Chicago, Ill.
H. Wiedeman, Chemist, St. Louis, Mo.

TESTING MACHINERY

Eimer & Amend, New York, N. Y.
Riehle Bros. Testing Machine Co., Philadelphia, Pa.
Thwing Instrument Co., Philadelphia, Pa.
Tinius Olsen Testing Machine Co., Philadelphia, Pa.

TESTING SIEVES AND SHAKERS

The W. S. Tyler Co., Cleveland, O.—see page 141

THERMOMETERS

See Pyrometers

THICKENERS

See Agitators

TRACK EQUIPMENT

American Frog & Switch Co., Hamilton, O.
Atlas Car & Mfg. Co., Cleveland, O.—see page 160
The Biehl Iron Works, Inc., Reading, Pa.
Birmingham Rail & Locomotive Co., Birmingham, Ala.
The Buda Co., Chicago, Ill.
C. S. Card Iron Works, Denver, Colo.
Central Frog & Switch Co., Cincinnati, O.—see page 167
Cincinnati Frog & Switch Co., Cincinnati, O.

The Cleveland Railway Supply Co., Cleveland, O.
Co-operative Utilities Co., Philadelphia, Pa.
Easton Car & Construction Co., New York, N. Y.—see page 159
The Electric Controller & Mfg. Co., Cleveland, O.
Elliott Frog & Switch Co., East St. Louis, Ill.
Fairmont Mining Machinery Co., Fairmont, W. Va.
L. B. Foster Co., Pittsburgh, Pa.
M. K. Frank, Pittsburgh, Pa.
C. W. Hunt & Co., Inc., W. New Brighton, N. Y.
The Hyde & Co., Pittsburgh, Pa.
Hyman-Michaels Co., Chicago, Ill.
International Clay Machinery Co., Dayton, O.
Koppel Industrial Car & Equipment Co., Koppel, Pa.
Lakewood Eng. Co., Cleveland, O.
Maris Bros., Philadelpha, Pa.
Pettibone Mulliken Co., Chicago, Ill.
Weir Frog & Switch Co., Cincinnati, O.
Western Wheeled Scraper Co., Aurora, Ill.

TRACTORS

Adamson Motor Co., Birmingham, Ala.
Allis-Chalmers Mfg. Co., Milwaukee, Wis.—see pages 14-15
Atlas Car & Mfg. Co., Cleveland, O.—see page 160
Brookville Truck & Tractor Co., Brookville, Pa.
Clark Tructractor Co., Chicago, Ill.—dump
Kansas City Hay Press & Tractor Co., Kansas City, Mo.—see page 121
Traylor Eng. & Mfg. Co., Allentown, Pa.—see page 142

TRANSFORMERS

See Electric Motors

TRANSMISSION MACHINERY

Allis-Chalmers Mfg. Co., Milwaukee, Wis.—see pages 14-15
The Baldwin Chain & Mfg. Co., Worcester, Mass.
W. E. Caldwell Co., Louisville, Ky.
The H. D. Caldwell Co., Chicago, Ill.—see page 123
C. S. Card Iron Works Co., Denver, Colo.
Chain Belt Co., Milwaukee, Wis.—see page 3
Cleveland Worm & Gear Co., Cleveland, O.—see page 145
Colonial Supply Co., Pittsburgh, Pa.
R. & J. Dick Co., Inc., Passaic, N. J.
Dodge Sales & Engineering Co., Mishawaka, Ind.
J. B. Ehrsam & Sons Mfg. Co., Enterprise, Kan.—see page 124
Falk Corporation, Milwaukee, Wis.
Fawcus Machine Co., Pittsburgh, Pa.
Foote Bros. Gear & Machine Co., Chicago, Ill.
Frost Drive Co., Worcester, Mass.
Wm. Ganschow Co., Chicago, Ill.
Gifford-Wood Co., Hudson, N. Y.
The Greenville Mfg. Co., Greenville, O.—see page 154
Gruendler Patent Crusher & Pulverizer Co., St. Louis, Mo.—see page 118
The Hanson Clutch & Machinery Co., Tiffin, O.
Hesse-Ersted Iron Works, Portland, Ore.
The Hill Clutch Co., Cleveland, O.—parts
Howe Chain Co., Muskegon, Mich.
Hyatt Roller Bearing Co., New York, N. Y.
W. A. Jones Fdry. & Machine Co., Chicago, Ill.
Link-Belt Co., Chicago, Ill.—see page 122 and back cover
Medart Co., St. Louis, Mo.
Meese & Gottfried Co., San Francisco, Calif.
W. F. Mosser & Son, Allentown, Pa.
Morse Chain Co., Ithaca, N. Y.—see pages 6-7
Munson Mill Machinery Co., Inc., Utica, N. Y.—see page 149
Niles-Bement-Pond Co., New York, N. Y.
R. D. Nuttall Co., Pittsburgh, Pa.
Pettibone-Mulliken Co., Chicago, Ill.
Philips Pressed Steel Pulley Works, Philadelphia, Pa.
Plamondon Mfg. Co., Chicago, Ill.
Pool Engineering & Machinery Co., Baltimore, Md.
Paul S. Reeves & Son, Philadelphia, Pa.
Smith & Serrell, Newark, N. J.
Stearns-Roger Mfg. Co., Denver, Colo.
Sturtevant Mill Co., Boston, Mass.—see page 163
Tool Steel Gear & Pinion Co., Cincinnati, O.
Union Eng. Co., Cleveland, O.
Webster Mfg. Co., Chicago, Ill.—see pages 126-127
Weller Mfg. Co., Chicago, Ill.—see page 134
Williams Pat. Crusher & Pulverizer Co., St. Louis, Mo.—see page 132

TRUCKS—Car

The Atlas Car & Mfg. Co., Cleveland, O.—see page 160
Brookville Truck & Tractor Co., Brookville, Pa.
Easton Car & Construction Co., New York, N. Y.—see page 159
Koppel Industrial Car & Equipment Co., Koppel, Pa.
Lakewood Engineering Co., Cleveland, O.
Hockensmith Mine Car Co., Penns, Pa.
Ottumwa Iron Works, Ottumwa, Ia.—patented roller bearings, see page 146
Penn Foundry & Mfg. Co., Reading, Pa.
Sanford-Day Iron Works, Knoxville, Tenn.
Southern Wheel Co., St. Louis, Mo.
Universal Crusher Co., Cedar Rapids, Ia.—see page 163
Watt Mining Car Wheel Co., Barnesville, O.—see page 167
Western-Wheeled Scraper Co., Aurora, Ill.

TUNNELING MACHINES

Hoar Shovel Co., Duluth, Minn.—see page 119
Lake Superior Loader Co., Duluth, Minn.
Myers Whaley Co., Knoxville, Tenn.

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TURBINES

Allis-Chalmers Mfg. Co., Milwaukee, Wis.—see pages 14-15
De Laval Steam Turbine Co., Trenton, N. J.—steam
General Electric Co., Schenectady, N. Y.
Moore Steam Turbine Corp., Wellsville, N. Y.
B. F. Sturtevant Co., Boston, Mass.
The Terry Steam Turbine Co., Hartford, Conn.
Wellman-Seaver-Morgan Co., Cleveland, O.
Westinghouse Electric & Mfg. Co., E. Pittsburgh, Pa.
Worthington Pump & Mach. Co., New York, N. Y.

UNDERGROUND LOADERS

Hoar Shovel Co., Duluth, Minn.—see page 119
Lake Superior Loader Co., Duluth, Minn.
Myers-Whaley Co., Knoxville, Tenn.

USED EQUIPMENT

Birmingham Rail & Locomotive Co., Birmingham, Ala.
The Cameron & Barkley Co., Charleston, S. C.
Chicago Electric Co., Chicago, Ill.
The Cleveland Belting & Machinery Co., Cleveland, O.
J. F. Davis & Sons Co., Chicago, Ill.
H. R. Eicher, Pittsburgh, Pa.—see page 188
M. K. Frank, Pittsburgh, Pa.
Great Lakes Equipment Co., Chicago, Ill.
The Greenville Gravel Co., Greenville, O.
W. P. Heineken Co., New York, N. Y.
The Hyde & Co., Pittsburg, Pa.
Industrial Equipment Co., Chicago, Ill.
Kleinhans Co., Pittsburgh, Pa.
E. J. Lavino & Co., Philadelphia, Pa.
Machinery & Supply Co., Joplin, Mo.
National Belting & Salvage Co., Milwaukee, Wis.
Reading Engineering Co., New York, N. Y.
Ross Power Equipment Co., Indianapolis, Ind.
E. H. Wilson & Co., Philadelphia, Pa.
Zelnicker Supply Co., St. Louis, Mo.

VALVES

Bay City Foundry & Machine Co., Bay City, Mich.
Colonial Supply Co., Pittsburgh, Pa.
Crane Co., Chicago, Ill.
R. & J. Dick Co., Inc., Passaic, N. J.
Dixon Valve & Coupling Co., Philadelphia, Pa.
The Emerson Pump & Valve Co., Alexandria, Va.—see page 156
Lunkenheimer Co., Cincinnati, O.
Jenkins Bros., New York, N. Y.
Kelly & Jones Co., Greensburg, Pa.
Knox Mfg. Co., Philadelpha, Pa.
Manning, Maxwell & Moore, Inc., New York, N. Y.
Meese & Gottfried Co., San Francisco, Calif.
Nelson Valve Co., Philadelphia, Pa.
United Lead Co., New York, N. Y.

VIBRATORS—Electrical

Schaffer Engineering & Equipment Co., Pittsburgh, Pa.—see inside front cover
W. S. Tyler Co., Cleveland, O.—see page 141
Stimpson Equipment Co., Salt Lake City, Utah

WAGONS

The Austin Western Road Machinery Co., Chicago, Ill.—see page 150
The Greenville Mfg. Co., Greenville, O.—see page 154
Miami Trailer Co., Troy, O.
Troy Wagon Works, Troy, O.
Western Wheeled Scraper Co., Aurora, Ill.—dump

WASHERS

Allen Cone Co., El Paso, Texas
Allis-Chalmers Mfg. Co., Milwaukee, Wis.—see pages 14-15
Good Roads Machinery Co., Inc., Kennett Square, Pa.—see page 135
Diester Concentrator Co., Ft. Wayne, Ind.
Greenville Mfg. Co., Greenville, O.—see page 154
Lewistown Foundry & Machine Co., Lewistown, Pa.—see page 129
Link-Belt Co., Chicago, Ill.—see page 122 and back cover
McLanahan-Stone Machine Co., Hollidaysburg, Pa.—see page 163
Smith Eng. Works, Millwaukee, Wis.—see page 155
The Stevenson Co., Westville, O.—screw
H. R. Wahl & Co., Chicago, Ill.
Webster Mfg. Co., Chicago, Ill.—see pages 126-127
Weller Mfg. Co., Chicago, Ill.—see page 134

WATER SOFTENING SYSTEMS

Wm. B. Scaife & Sons Co., Oakmont, Pa.
Scientific Boiler Chemical Works, Chicago, Ill.
Wayne Tank & Pump Co., Ft. Wayne, Ind.

This journal being a member of the Associated Business Papers, Inc., assures you that the advertisements in ROCK PRODUCTS are accepted only because they play an important part in serving you. There are no fake ads here, nor ads that influence the tone of our editorial pages.

WEIGHING EQUIPMENT

Automatic Weighing Machine Co., New York, N. Y.
Bates Valve Bag Co., Chicago, Ill.—see page 18-19
Richardson Scale Co., Passaic, N. J.—automatic, see page 151
Schaffer Eng. & Equipment Co., Pittsburgh, Pa.—inside front cover.
Western Valve Bag Co., Chicago, Ill.
Valve Bag Co. of America, Toledo, O.—see page 4-5

WELDING AND CUTTING EQUIPMENT

Aeroil Burner Co., Inc., Union Hill, N. J.
The Alexander Milburn Co., Baltimore, Md.
Allan Mfg. & Welding Corp., Buffalo, N. Y.
Burke Electric Co., Erie, Pa.—see page 160
The Champion Blower & Forge Co., Lancaster, Pa.
O. H. Davidson Equipment Co., Denver, Colo.
Electric Arc Cutting & Welding Co., Newark, N. J.
General Electric Co., Schenectady, N. Y.
Goodman Mfg. Co., Chicago, Ill.
Imperial Brass Mfg. Co., Chicago, Ill.
The Lincoln Electric Co., Cleveland, O.
The MacLeod Co., Cincinnati, O.
Metal & Thermit Corp., New York, N. Y.
The Ohio Brass Co., Mansfield, O.
Oxweld Acetylene Co., Newark, N. J.
H. N. Strait Co., Kansas City, Mo.
Universal Oxygen Co., Sheboygan, Wis.
Westinghouse Electric & Mfg. Co., E. Pittsburgh, Pa.

WHEELS—Car

American Car & Foundry Co., Chicago, Ill.
American Manganese Steel Co., Chicago Heights, Ill.—see page 156
The Atlas Car & Mfg. Co., Cleveland, O.—see page 160
Baker Car Co., Harriman, Tenn.
The Buda Co., Chicago, Ill.—cast iron
C. S. Card Iron Works Co., Denver, Colo.
Easton Car & Construction Co., New York, N. Y.—see page 159
Fuller-Lehigh Co., Fullerton, Pa.
Griffin Wheel Co., Chicago, Ill.
Gustafson Mfg. Co., Chattanooga, Tenn.
Joshua Hendy Iron Works, San Francisco, Calif.
Hockensmith Wheel & Mine Car Co., Penn, Pa.
Kenova Mine Car Co., Kenova, W. Va.
Koppell Industrial Car & Equip. Co., Koppel, Pa.
Lake Shore Engine Wks., Marquette, Mich.
Lobdell Car Wheel Co., Wilmington, Del.
Meese & Gottfried Co., San Francisco, Calif.
Ogden Iron Works, Ogden, Utah
Ottumwa Iron Works, Ottumwa, Ia.—see page 146
Pennsylvania Casting & Machine Works, Pittsburgh, Pa.
Pettibone Mulliken Co., Chicago, Ill.
Sanford-Day Iron Works, Knoxville, Tenn.
Southern Wheel Co., St. Louis, Mo.
Stroh-Steel-Hardening Process Co., Pittsburgh, Pa.—sheave, car, crane track.
Taylor-Wharton Iron & Steel Co., High Bridge, N. J.—see page 133
Watt Mining Car Wheel Co., Barnesville, O.—see page 167

WINCHES AND CAPSTANS

American Hoist & Derrick Co., St. Paul, Minn.—see page 161
Bay City Foundry & Machine Co., Bay City, Mich.
The Biehl Iron Works, Inc., Reading, Pa.
James A. Channon Mfg. Co., Chicago, Ill.
Chicago Pneumatic Tool Co., New York, N. Y.
Dobbie Foundry & Machine Co., Niagara Falls, N. Y.
The Erie Hoist Co., Erie, Pa.—motor truck
S. Flory Mfg. Co., Bangor, Pa.—see page 147
The Hadfield-Penfield Steel Co., Bucyrus, O.—see page 152
Joshua Hendy Iron Works, San Francisco, Calif.
Hyman-Michaels Co., Chicago, Ill.
Indiana Foundry Co., Inc., Indiana, Pa.
International Motor Co., New York, N. Y.
Link-Belt Co., Chicago, Ill.—see page 122 and back cover
Meese & Gottfried Co., San Francisco, Calif.
Mining Machine Co., Mountville, Pa.—see page 159
Standard Steel Works, North Kansas City, Mo.
Superior Iron Works, Superior, Wis.
Thomas Elevator Co., Chicago, Ill.—see page 147
Universal Hoist & Mfg. Co., Cedar Falls, Ia.
Webster Mfg. Co., Chicago, Ill.—see page 126-127
Weller Mfg. Co., Chicago, Ill.—see page 134

WIRE CLOTH

Audubon Wire Cloth Co., Audubon, N. J.
Buffalo Wire Works Co., Buffalo, N. Y.
Cleveland Wire Cloth & Mfg. Co., Cleveland, O.
Ludlow-Saylor Wire Co., St. Louis, Mo.
Newark Wire Cloth Co., Newark, N. J.
Twin City Iron & Wire Co., St. Paul, Minn.
The W. S. Tyler Co., Cleveland, O.
G. F. Wright Steel & Wire Co., Worcester, Mass.
Wickwire-Spencer Steel Corp., Worcester, Mass.

WIRE ROPE—Cableway, Conveyor, Crane, Derrick, Dredge, Guy, Hoisting, Loading Machinery, Mining, Haulage, Steam Shovel

American Steel & Wire Co., Chicago, Ill.—see page 166

Buyers' Directory
of the Rock Products Industry

Broderick & Bascom Rope Co., St. Louis, Mo.
O. H. Davidson Equipment Co., Denver, Colo.
Dodge Sales & Eng. Co., Mishawaka, Ind.
A. Leschen & Sons Rope Co., St. Louis, Mo.—see inside back cover.
Link-Belt Co., Chicago, Ill.—see page 122 and back cover
Macwhyte Co., Kenosha, Wis.
Meese & Gottfried Co., San Francisco, Calif.
George C. Moon Co., Garwood, N. J.
Pittsburgh Mining Machinery Co., Pittsburgh, Pa.
John A. Roebling's Sons Co., Trenton, N. J.
Upson-Walton Co., Cleveland, O.
Waterbury Co., New York, N. Y.
Wickwire Spencer Steel Corp., Worcester, Mass.
Williamsport Wire Rope Co., Chicago, Ill.

WIRE ROPE ACCESSORIES

American Hoist & Derrick Co., St. Paul, Minn.—see page 161
American Steel & Wire Co., Chicago, Ill.—see page 166

When you read it in ROCK PRODUCTS you can believe it. Because these pages are clean, they are truthful and are edited by men who know the technical and business side of this industry.

O. H. Davidson Equipment Co., Denver, Colo.
Hazard Mfg. Co., Wilkes-Barre, Pa.
A. Leschen & Sons Co., St. Louis, Mo.—see inside back cover

Link-Belt Co., Chicago, Ill.—see page 122 and back cover
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Sauerman Bros., Chicago, Ill.—see page 157
Waterbury Co., New York, N. Y.
Wickwire Spencer Steel Corp., Worcester, Mass.
Williamsport Wire Rope Co., Williamsport, Pa.

WIRES AND CABLES—Electrical

American Brass Co., Waterbury, Conn.
American Steel & Wire Co., Chicago, Ill.—see page 166
General Electric Co., Schenectady, N. Y.
Hazard Mfg. Co., Wilkes-Barre, Pa.
John A. Roebling's Sons Co., Trenton, N. J.
Standard Underground Cable Co., St. Louis, Mo.
The Wickwire Spencer Steel Corp., Worcester, Mass.

Used Equipment

Rates for advertising in the Used Equipment Department: $2.50 per column inch per insertion. Minimum charge, $2.50. Please send check with your order. These ads must be paid in advance of insertion

FOR SALE

2—8x110′ Rotary Kilns.
5—5x6x7x110′ Rotary Kilns.
5—5x21′ Tube Mills (1 has Silax lining, 3 steel lining, 1 without lining).
1—4′ 6″x40′ Coal Dryer.
2—No. 6 Gates Crushers.
3—5½x22′ Tube Mills.
2—6x50′ Rotary Dryers.
3—Kominuters.
6—Krupp Ball Mills.
3—33″ Fuller Mills.
2—6x60′ Rotary Dryers.

ENGINEERING SALES COMPANY, Nashville, Tenn.
OLLIE LAWRENCE, Stockertown, Pa.

FOR SALE

1—20 H.P. D. C. Motor.
3—3 H.P. Westinghouse A. C. Motors (new).
1—Westinghouse Auto. Starter—5 H.P.
1—Allen Bradley Motor Starter—25 H.P.
1—Bessemer Gas Engine—200 H.P. (almost new).
1—Buckeye Steam Engine—100 H.P.
1—Phillips Gas Engine—25 H.P.
1—Vertical Boiler—200 H.P.
1—Pumping Jack.
1—Drill Press.
2—Traylor Ball Mills 7′ dia. x 6′ long.

Little Buffalo Creek Sand Co.
Plant—Cabot, Pa. Office—Glassmere, Pa.

FOR SALE

Unused Emerson Brantingham Double Cylinder Single Drum **Hoists** in first-class condition, f.o.b. Chicago, **$100** each. Immediate shipment. Full specifications furnished on application.

Hyman-Michaels Company
Peoples Gas Bldg. Chicago

Wanted Immediately

Twelve to fifteen 6-yard two-way side dump cars completely equipped with steel lined bottoms. Give location, description and price. Address

Box 1608, Care of Rock Products
542 South Dearborn Street Chicago, Ill.

Machinery For Sale

DRYERS—Direct-heat rotary dryers, 3x25′, 3½x25′, 4x30′, 5½x50′, 6x60′ and 7x60′; double shell dryers, 4x20′, 5x30′ and 6x35′; steam-heated air rotary dryers, 4x30′ and 6x30′.

KILNS—Rotary kilns, 4x40′, 5x50′ and 6x70′, 6x100′, 7x80′ and 8x110′.

MILLS—6x8′, 6x5′, 5x4′, 3x3½′ pebble and ball mills; 3′ March mill; 42″, 33″ and 24″ Fuller-Lehigh mills; 4½x20′, 5x11′, 5x20′, 5½x22′ and 6x20′ tube mills; 7½x13″, 9x15″, 16x10″ and 12x26″ jaw crushers; one "Infant" No. 00, No. 0, No. 2, No. 3, and No. 9 Williams' swing hammer mills; one Kent type "G" mill; 24″, 36″ and 40″ cage mills; 3′ and 4½′, 6′ and 8′ Hardinge mills; 18x12″, 20x12″ and 30x10″ roll crushers; No. 0, No. 1 and No. 3 Sturtevant rotary crushers; one No. 2 Sturtevant ring roll crusher; 5 roll and 2 roll No. 1 and No. 000, No. 00 and No. 0 Raymond mills; one No. 3 and No. 4 and No. 7½ Telsmith breaker; one 36″ Sturtevant emery mill; one 3 roll Griffin mill; 60″ chaser mill.

SPECIALS—Five automatic package weighing machines; jigs; 6x8′, 6x5′ and 4x3′ Newaygo vibrating screens; Richardson automatic scales; 8′ and 10′ Emerick air separators.

Air compressors.

W. P. Heineken, Engineer
95 Liberty Street, New York. Tel. Cortland 1841

Mine Cars, Rails and Ties

We have mine cars in stock for all purposes. Also rails 12 lb. to 100 lb. section. Spikes, bolts, frogs and switches. All trade is solicited and prices cheerfully quoted.

M. K. FRANK
Frick Building Pittsburgh, Pa.

WANTED

Revolving Screens: 2—5 ft. x 20 ft.
2—6 ft. x 12 ft.

State full particulars and best cash price

DOLESE BROS. CO.
337 W. Madison St. Chicago, Ill.

Have you a plant for sale? Do you wish to purchase a plant? Are you in need of a superintendent or manager? Are you looking for a position as plant superintendent or manager? Advertise your wants in these columns for quick results.

FOR SALE

3 12x12 Thomas Hoists
3 1½ yard Dull Buckets
1 1 yard Dull Bucket
2 Masts 80 feet long
1 Mast 50 feet long
Masts all equipped with guy cables, sheaves, trolley and tension cables.
2 100 hp. Steam Boilers
8 20 inch diameter, 28 inch face, drive and tail pulleys equipped with gears and bearings.

Fuller-Becker Sand and Gravel Company
Detroit, Mich.

FOR RENT AND SALE

14—4-yd. 36-in. ga. heavy duty Western dump cars.
20—12-yd. Western air dump cars, std. gauge.
50—60,000-lb. capacity flat and box cars.
1—Western standard gauge spreader, used sixty days.
1—Osgood 18 revolving shovel, traction wheels, No. 794, ¾ yd. bucket, built 1920.
1—Marion 76 steam shovel, No. 3503, std. gauge, weight 110 tons, used 10 months.
1—Class 14 Bucyrus dragline on caterpillars, 70-ft. boom, 2-yd. bucket, built 1921.
2—Foote 40-S 1-yd. side discharge concrete mixers, with steam engine and boiler.
32—NEW 20-in. I beams, 80 lbs. per foot, 40 feet long, not drilled.
1—NEW Lakewood concrete chuting system.

LOCOMOTIVES

1—50-ton 18x24-in. six-wheel switcher.
1—40-ton 17x24 in. four-wheel switcher.
2—NEW 24-ton six wheel Porters, separate tender, 36-in. gauge.
2—18, 14 and 10-ton Vulcans, 36-in. gauge.

INDUSTRIAL EQUIPMENT CO.
McCormick Building Chicago, Illinois

IMMEDIATE DELIVERY

Send Us Your Steam Shovel Inquiries

66x86 in. Traylor Jaw Crusher.
No. 18K Gates Crusher.
25, 50, 80, 110 HP. Electric Hoists.
Nos. 4, 5, 6, 7½, 9 and 10 Crushers.
6 and 12-ton Gasoline Locomotives.
2 Disc Crushers, 36 and 24 in. Symons.
100-ton 2½ yd. Electric Shovel.
50 5000 ft. Steam, Belt and Electric Drive Comp.
13x30 in., 10x18 in., 9x14 in. Jaw Crushers.
24x54 in. McLanahan Roll Crusher.
New 5 Kw. and 25 Kw. G. E., 125 V. direct connected.
Gasoline Engine sets. Bargains.
1000 Gpm. Underwriters' Steam Pump.
Send us your inquiries for your requirements.

ROSS POWER EQUIPMENT CO.
Indianapolis, Ind.

For Sale—STEAM SHOVEL

⅝ YD. THEW "O" TRACTION

Thoroughly rebuilt; attractive terms for quick sale.

Walter A. Zelnicker Supply Co., St. Louis
Rails, Locomotives, Cars, Tanks, Pipe

FOR SALE

One Kritzer six drum Hydrator in perfect condition.

PALMER LIME & CEMENT CO.
103 Park Ave., New York, N. Y.

Used Equipment

Rates for advertising in the Used Equipment Department: $2.50 per column inch per insertion. Minimum charge, $2.50. Please send check with your order. These ads must be paid for in advance of insertion.

Telephone Court 4508-4509

H. R. EICHER

608-609 Maloney Bldg. Pittsburgh, Penna.

We have purchased from the Consolidation Coal Co. and the Cumberland & Pennsylvania R. R. Co. all of their Surplus Equipment. In this lot we have listed below some of the items and equipment that might be of interest to you at a very low figure. This material is all in A-1 condition, mechanically and otherwise, and will be loaded f. o. b. Frostburg, Md., and can be inspected at that point. Detailed specification on any item obtainable at our Pittsburgh office.

1—Norwalk 3-stage Air Compressor, straight line with intercoolers; steam pressure 125 lb.; air pressure 900 lb.; capacity 750 cu. ft. at 85 R.P.M. $2000.00

1—Ingersoll Duplex Cooper-Corliss, steam pressure 125 lb.; air pressure 900 lb.; capacity 1409 cu. ft. free air at 80 R.P.M. $2000.00

2—Ingersoll-Rand Imperial Type 10, capacity 1319 cu. ft. per minute; piston displacement at 150 R.P.M.; complete with 1-KY General Electric 200 H.P. Motor 3-phase, 60 cycle, 220 volts; 600 R.P.M. with C. R. 1034-H3 Compensator base and pulley 24x32x5; also complete with Air Receivers, Gauges, Fittings, etc. $3500.00 each

1—Ingersoll-Rand Class J-2 single acting 2-stage 24¼x14¼x18 in.; capacity 1000 cu. ft.; maximum pressure 100 lb. at 135 R.P.M.; complete with 1-200 H.P. Westinghouse Motor 3-phase, 60-cycle, 220 volts with slide rails, pulley and starting device; also 1-55 ft. 21-in. 2-ply Endless Leather Belt; complete with Air Receivers, Gauges, Fittings, etc. $3500.00

3—Air Receivers, 30-in. dia. x 20 ft. long, tested 1000 lb. pressure. $75.00 each

1—Air Receiver, 60 in. dia. x 12 ft. long, tested 150 lb. pressure. $50.00

1—150 H.P. Butt strapped triple riveted H. R. T. Boiler, complete with stacks, fronts, fittings, buck-stays, etc. $600.00

2—Westinghouse Standard Steam Engines, 7½x7 in., 350 R.P.M., 20 H.P. $75.00 each

1—Case Steam Engine, 8 H.P., pulley 18 in. x 6½ face, flywheels 18x5½, 648 R.P.M. $20.00

1—110 K.W. Allis-Chalmers A.C. Generators, 2200 volts, 225 R.P.M. direct connected to Harrisburg steam engine 16x14, 150 H.P., 225 R.P.M. $2000.00

2—150 K.W. Westinghouse D.C. Generators, 250-275 volts, 550 R.P.M. $1250.00 each

1—160 H.P. Buckeye Generator Engine, 18x18¾, pulley 90 in. x 26 in., 200 R.P.M. $600.00

1—Westinghouse stand. engine, 7½x7 in., 350 R.P.M., 125 lb. pressure direct connected to 15 K.W. Wood Generator, type MPL Compound wound, 350 R.P.M. 125 volts, complete with switchboard, instruments, main line switches, fuses, etc. $50.00

1—7x10 Single Drum double cylinder Mine Hoist; drum dia. 40 in., face 40 in. $400.00

1—H. K. Porter Air Locomotive, 6 wheel, 16 ton, 36 in. gauge. $600.00

1—Baldwin Air Locomotive, 6 wheel, 16 ton, 36 in. gauge. $600.00

1—H. K. Porter Air Locomotive, 6 wheel, 15 ton, 36 in. gauge. $600.00

1—Baldwin Compound Locomotive, 10 ton, 36 in. gauge. $450.00

4—Baldwin Gathering Locomotives, 4 ton, 36 in. gauge. $450.00 each

1—Storage Oil Tank, 8 ft. diameter, 30 ft. long. $200.00

FOR SALE

Advance Pump No. 18685, cyl. 3x2x3—Little Creek, Mich.
Walton Battery Charger and Switch Board, Ser. 3324, Ser. 3324, Type B x 24, 24 Cells, 35 H.P.
12 bbl. Heaters, pipe attached
9 New Pots for above
5 Bases for Heaters
1 No. 38 Holmes Crozer
8 15-in. Raising Jacks (Forms)
7 17¼-in. Raising Jacks (Forms)
Electro Mobile No. 245, Type B 3000-lb. Carry. Capy. 10,000-lb. Pull. Capy.
Orenstein-Arthur-Koppel Co., Koppel, Pa.
American Filter, Vertical Rotary Type 4-1, United Filters Company
Hand Chalk Machine S. T. Witchell Co., Philadelphia
1 No. 3 Sturtevant Fan Monogram size 3, Des. 2, No. 61429
1 No. 3 as above, No. 5595
E. R. No. 1, 4x4 Vacuum Pump
Ingersoll Rand, No. 39277
3 Barrel Headers, hand and foot operated
Ingersoll Rand Pump No. 39277
Air Cyl. 4x4
D.C. Motor C & C Electric Co. No. 12565, Type S 25 H.P., 250 Volt, 85 Amp., 825 Speed
50 17-in. Head Rings
50 17-in. Bilge Rings
Cut-off Saw and Frame
1 Holmes No. 59 Windlass
Model C Simplex, ¼ size Darr Classifier, 16 strokes per minute
3-in. Drain, 1493C Ser.
S. Howes Co., "Eureka" Barrel Packer, Single Fill Hand Operated, Silver Creek, N. Y.
2 Invincible Sackers for open mouth bags, 8 foot wood frame
2 Pneumatic Head Hoop Drivers, equipped for air or steam
2 R. D. Wood & Co. Mechanical Tops for Gas Producers

For further information apply to

Palmer Lime & Cement Co., 103 Park Ave., New York City

2—50-ton standard gauge Baldwin 6-wheel switchers, built 1913.

1—42-ton standard gauge Heisler geared locomotive, built 1910.

1—42-ton standard gauge Shay geared locomotive.

1—12x18" standard gauge 4-wheel saddle tank.

1—23-ton new 36" gauge Porter 6-wheeler with separate tender.

10—5-ton 36" gauge storage battery locomotives.

1—14-B Bucyrus steam shovel, mounted on traction wheels.

Birmingham Rail and Locomotive Co.
Birmingham, Alabama

DEPENDABLE SERVICE

Hyman-Michaels Co.

531 Peoples Gas Bldg., Chicago, Ill.

RELAYING RAILS AND ANGLE BARS

In All Weights, 30 to 100 Lb. to the Yd.

Quick Shipment
Dependable Service

Get Our Quotations Today

We Also Cut Rails to Lengths for Props, Etc.

OFFICES AT

New York City, 1324 Woolworth Bldg.
Pittsburgh, Pa., 1312 1st Nat'l Bank Bldg.
St. Louis, Mo., 2115 Railway Ex. Bldg.

Classified Advertising

Rates for advertising in the Used Equipment Department: $2.50 per column inch per insertion. Minimum charge, $2.50. Please send check with your order. These ads must be paid for in advance of insertion.

FOR SALE
All or Interest in

300 acres hard limestone land, with 1500x 30 ft. open quarry face. Large new, crushing and screening, plant of 3000 tons daily capacity; centrally located to large demand for material; orders amounting to $200,000 on our books.

Capable man with $25,000 up, and knowledge of business can make big money, if act promptly.

Location in Southwest.

Box 1603, Care of Rock Products
542 South Dearborn Street, Chicago, Ill.

Exceptional Business Proposition for Practical Stone Operator

FOR SALE—Part or controlling interest: Largest hard Limestone quarrying and crushing plant in Southwest. See **Mr. Dodson, LaSalle Hotel,** Chicago, during N. C. S. Ass'n Convention, Jan. 15 to 17, for particulars, or address care Rock Products, 542 South Dearborn Street, Chicago, Ill.

CAPITAL WANTED

I have 100 acres ideal sand and gravel on railway, rapid river, and located in the central south where exists a market for a large output. My plant being small, I invite additional capital. Please address

Box 1612, Care of Rock Products
542 South Dearborn Street Chicago, Ill.

George Borrowman, Ph.D.
CHEMIST

Analyses, consultations, researches in connection with rock products, cements, clays, lime, plasters, zeolites, sands, etc.

9 So. Clinton St. Chicago, Ill.

Position Wanted

Have had 20 years' experience in the production of sand and gravel and wish to communicate with a responsible gravel firm regarding position as superintendent. Am at present employed by a large plant near Chicago. Will be available as soon as plant closes for winter.

Address Box 1605, care Rock Products
542 S. Dearborn St. Chicago, Ill.

FOR SALE

Fully equipped stone crushing and ground limestone plant. Located on Pennsylvania R. R. Splendid rail connections for Indianapolis and Madison, Ind.; Louisville, Ky., and Cincinnati, Ohio. 1000 feet of siding, steel tracks and dump cars; 52 acres of land, 20 of it solid stone with dry pit. 50-foot ledge of best stone. Well located for wagon trade. On state highway, in part of county where many roads are to be built. Near such cities as **Columbus, Edinburg, Brownstown, Seymore, Scottsburg, Madison, Ind.** The best opportunity in the state for a man that wants to go into the stone business, and it will be sold on such terms that the purchaser can pay for it from the profits of the business. Write to

Mr. E. T. MILLIGAN
Box 271 Muncie, Indiana

WANTED

Position as superintendent of sand stone quarry and crushing plant. 16 years' experience in quarry and mill operations. Familiar with all details of the work. Prefer to locate in Ohio or New York state.

Address Box No. 1609, Care Rock Products,
542 S. Dearborn St. Chicago, Ill.

WANTED

A thoroughly experienced, qualified Superintendent for Lime Manufacturing Plant, using Rotary Kiln, located in most delightful section of Southern California. Must be able to invest not less than $5000 to ensure permanency.

Address General Manager
Room 612, San Fernando Bldg., Los Angeles, Cal.

WANTED

Man with sales experience in Sand and Gravel and Crushed Stone business for territory adjoining one of the largest producing plants in the northwest. Must reside at location of the plant. Address

Box 1607, Care of Rock Products
542 South Dearborn Street Chicago, Ill.

H. E. WIEDEMANN
(Est. 1905)
Consulting and Analytical Chemist

Specialist in Analysis of Rock Products
Chemical Bldg. St. Louis

WANTED:

Master Mechanic for limestone quarry and plant. Must assume complete responsibility for maintenance of steam shovels, locomotives, crushing and screening machinery, and electrical equipment. Must also be able to supervise new mechanical installations.

Young engineer with some experience in stone industry preferred.

Location—Western Pennsylvania.

Please reply in own handwriting giving training, experience and salary expected.

Address Box 1610, Rock Products
542 S. Dearborn St. Chicago, Ill.

WANTED

Quarry foreman for cement mill quarry in Lehigh District, Pennsylvania. Quarry produces about two thousand tons of stone per day with steam shovels. Foreman must look after loading, track work, and quarry transportation, strippings, drilling and blasting. State age and salary expected and give full experience with reference. Address

Box 1611, Care of Rock Products
542 South Dearborn Street Chicago, Ill.

WANTED:

Millwright to take charge of Plaster Mill repairs. Must be expert in this line and a hustler. Apply

P. O. Box 1295, Scottsville, N. Y.

WANTED

To lease or purchase—going lime plant with hydrating equipment in Eastern or Southeastern States. Reply with some details, plant and quarry equipment. Preference given, White Magnesium Lime. Address

Box 1602, Care of Rock Products
542 South Dearborn Street Chicago, Ill.

WANTED

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